

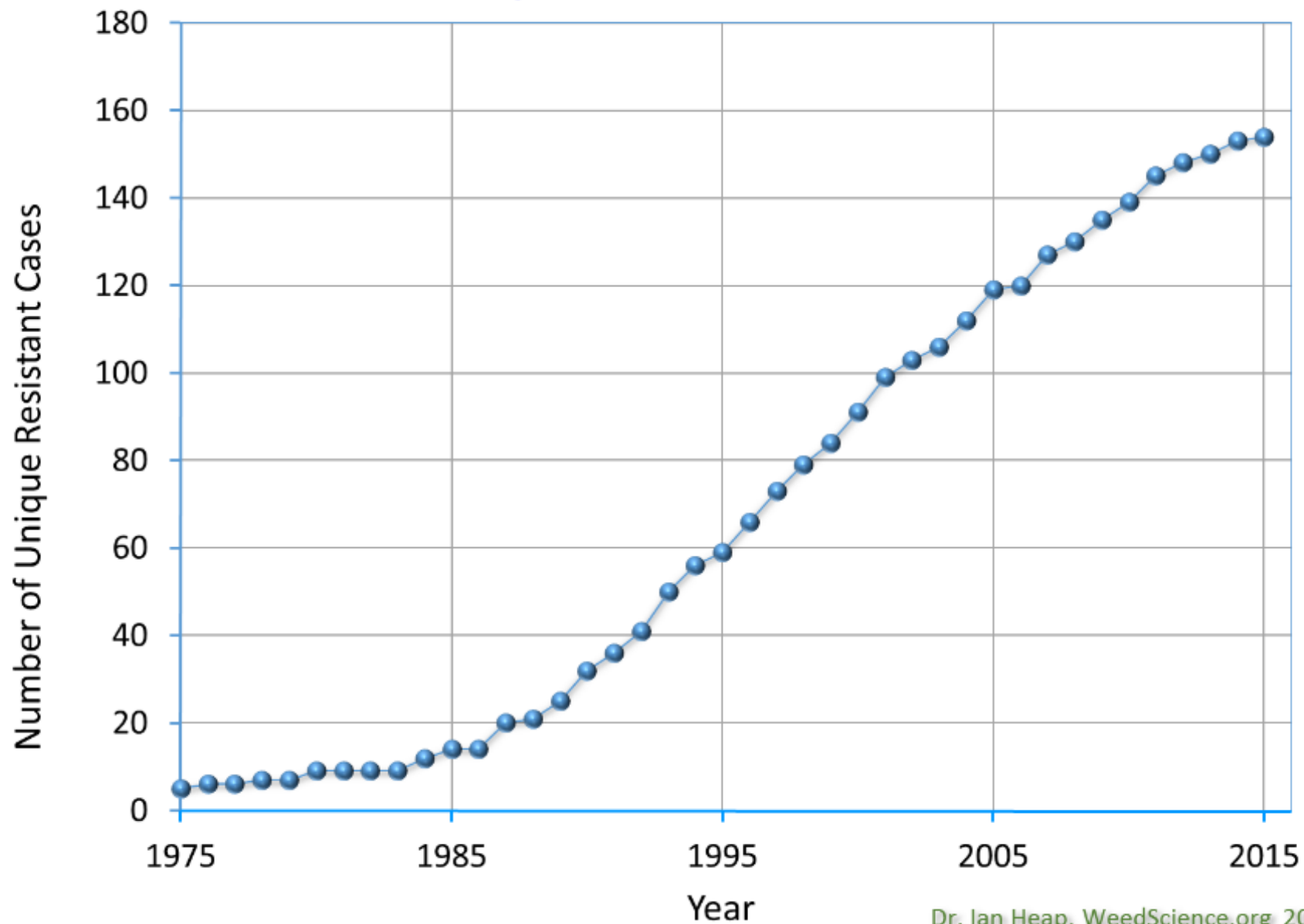
Management of Herbicide Resistant Weeds

Ben Beale

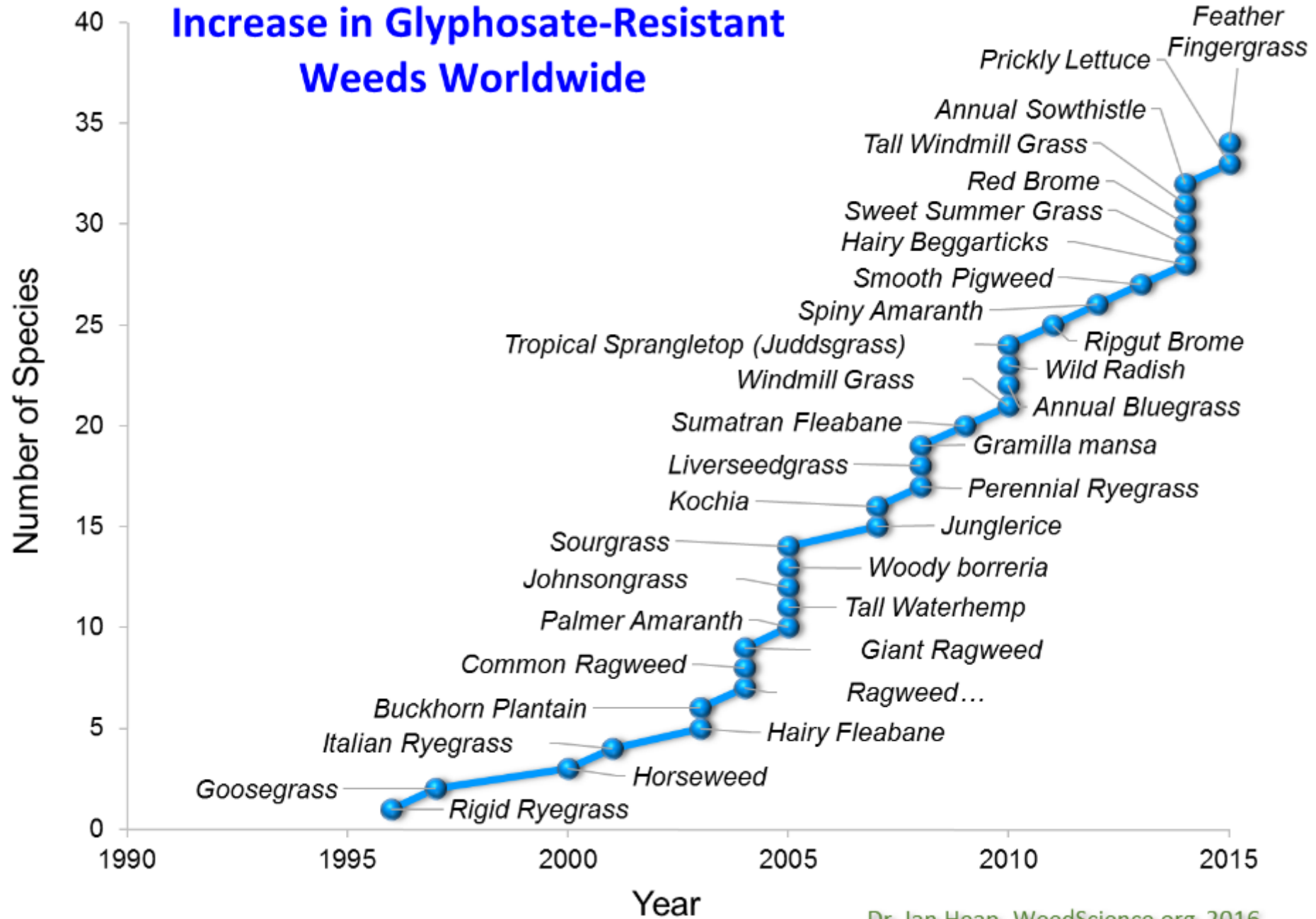
Extension Agent

University of Maryland Extension

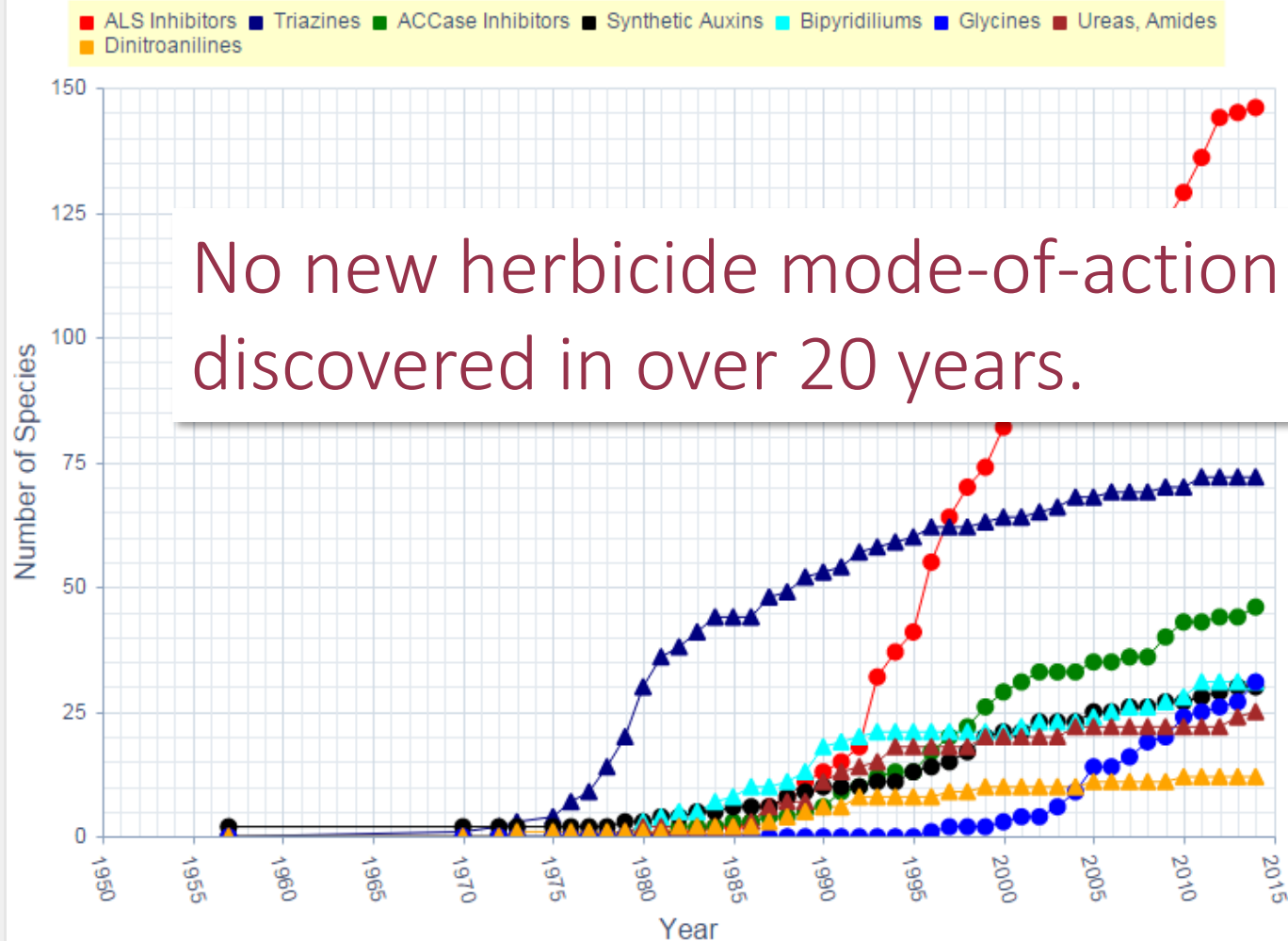
Increase in Unique Resistant Weed Cases for the USA



Increase in Glyphosate-Resistant Weeds Worldwide



Chronological Increase in Resistant Weeds Globally



No new herbicide mode-of-action has been discovered in over 20 years.

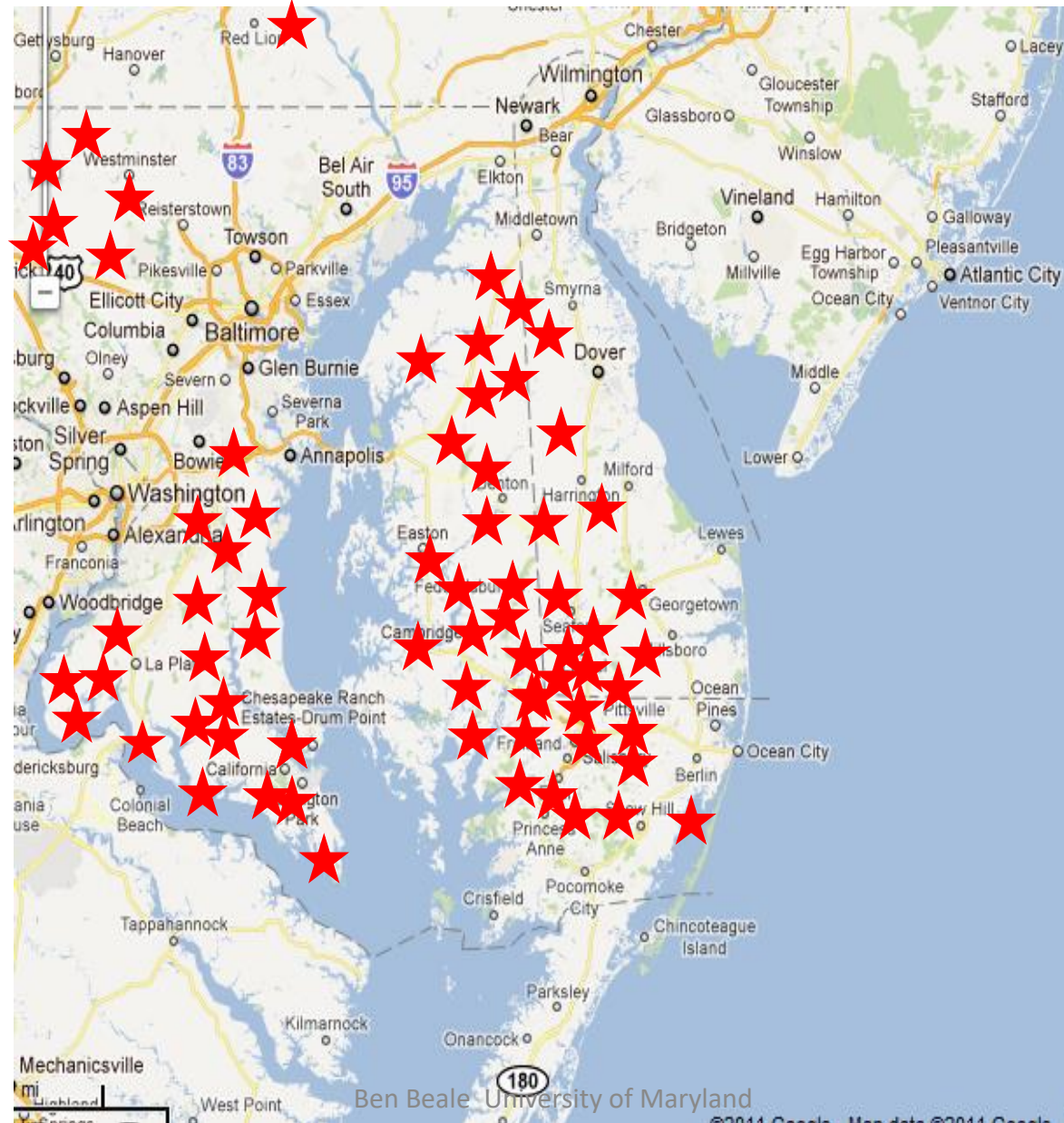
Slide from: Michael Flessner,
Extension Weed Specialist

Focus For Today...

- Palmer Amaranth
- Common Ragweed
- Marestalk
- Xtend, Enlist, Corteva, Liberty Traits
- Integrated Approaches



Have you seen Palmer lately?



Palmer amaranth characteristics:

- Aggressive weed:** endemic to the Sonoran Southwest desert
- Small seed size:**
- emerges from first inch of soil
 - adapted to no-till/low-till systems
 - spreads easily by irrigation water, wind, wildlife, equipment, grain/seed/feed
 - long germination period (March to August)
- Prolific seed production:** 100,000 to more than 500,000 per female plant
- Lack of seed dormancy:** very rapid seed bed formation
- Dioceous plant:** obligate out crosser from male to female plants
- Tolerance to POST:** only small plants are sensitive, less than 4 inches
- Very rapid growth rate:** desert plant growth behavior
- Herbicide resistance:** resistance against glyphosate, ALS inhibitors, cost for weed control double to triple (\$75/A and more)



Palmer Amaranth confirmed in SO MD in the summer of 2014



Fall 2014

ZERO TOLERANCE WEED: ONE IS TOO MANY!



Spring 2015





Fall 2018

Herbicides (rate/A)	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth/Waterhemp ^{1,2}	Pigweed ¹	Ragweed, Common ^{2,3}	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Injury
Basagran (1 qt)	6	N	9	9	8	N	N	6	6	8	7	8	9	8+	8+	FG
Cadet (0.9 oz)	14	N	N	N	7	7	7	7	7	N	N	7	N	7	9+	F
Classic (0.67 oz)	2	8	9+	9	7	7	N	9 ¹	9 ¹	8 ³	7+	N	8+	N	8	F
Cobra (12.5 fl oz)	14	8	8	9	7	8	8+	9	9	9	8+	6	7	7	8+	F-
FirstRate (0.3 oz)	2	6	9	8	N	8+	N	N	N	9 ³	9	N	8	9	9	VG
Glyphosate (0.75 lb ae) ⁴	9	8+	9	9	8+	8	8	9+ ²	9+	9 ²	8	8	8+	9	8	E
Harmony SG (0.125 oz) ⁵	2	7	7+	7	9	N	N	9 ⁵	9 ¹	6 ³	N	N	9	N	8+	— ⁶
Liberty (32 fl oz) ⁷	10	8	9	9	9	8	8	8+	8+	9	8+	8	8+	7+	8	VG
Pursuit (4 fl oz)	2	6	9	8	7	7+	8+	9 ¹	9 ¹	8 ³	6	6	8+	7	9	FG
Raptor (5 fl oz)	2	6	9	8	8+	7	8+	9 ¹	9 ¹	8 ³	8	6	8	7	9	G
Reflex/Flexstar (1.25 pt)	14	7	8	9	6	8	8+	9	9	9	8	N	8	6	7+	FG
Resource (6 fl oz)	14	6	6	7	7	N	8	7+	7+	7+	6	6	6	6	9+	FG
Ultra Blazer (1.5 pt)	14	7	8	9	7	8	8	9	9	9	8	N	8+	6	7+	F
Mixtures																
Extreme (3 pt) ⁴	2/9	8	9	9	8+	7+	8	9 ^{1,2}	9	8+ ^{2,3}	8	7	8+	8+	9	VG
Flexstar GT (4.5 pt) ⁴	9/14	8+	9	9	8+	8	8	9 ²	9	9 ²	9	8	8+	9	8+	F
Permit Plus (0.75 oz) ⁵	2/2	7	9	7	9	6	6	9 ¹	9 ¹	9 ³	8	7	9	—	9	— ⁶
Storm (1.5 pt)	6/14	6	8	9	7	7+	7	8+	8+	8+	7	7	8+	8	8	FG
Synchrony (0.75 oz) ⁵	2/2	8+	9+	9	9	7	N	9+ ¹	9+ ¹	8 ³	7+	N	9	N	9	— ⁶

¹ Pigweed biotypes resistant to Group 2 herbicides are common in the region; do not rely on Group 2 herbicides to provide effective pigweed control

² Glyphosate resistance has been confirmed for this species and it appears to be widespread in the region.

³ Common ragweed biotypes resistant to Group 2 herbicides have been confirmed in Delaware.

⁴ For use on Roundup Ready soybean varieties only.

⁵ For use on STS or non-STS soybean varieties; a lower rate must be used on non-STS varieties.

⁶ Excellent crop tolerance for STS varieties, but fair or worse ratings if used on non-STS varieties

⁷ For use on glufosinate-resistant soybean varieties only.

Resistance to: Glyphosate (9)

Herbicides (rate/A)	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth/Waterhemp ^{1,2}	Pigweed ¹	Ragweed, Common ^{2,3}	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Injury
Basagran (1 qt)	6	N	9	9	8	N	N	6	6	8	7	8	9	8+	8+	FG
Cadet (0.9 oz)	14	N	N	N	7	7	7	7	7	N	N	7	N	7	9+	F
Classic (0.67 oz)	2	8	9+	9	7	7	N	9 ¹	9 ¹	8 ³	7+	N	8+	N	8	F
Cobra (12.5 fl oz)	14	8	8	9	7	8	8+	9	9	9	8+	6	7	7	8+	F-
FirstRate (0.3 oz)	2	6	9	8	N	8+	N	N	N	9 ³	9	N	8	9	9	VG
Harmony SG (0.125 oz)⁵																
Harmony SG (0.125 oz) ⁵	2	7	7+	7	9	N	N	9 ⁵	9 ¹	6 ³	N	N	9	N	8+	— ⁶
Liberty (32 fl oz) ⁷	10	8	9	9	9	8	8	8+	8+	9	8+	8	8+	7+	8	VG
Pursuit (4 fl oz)	2	6	9	8	7	7+	8+	9 ¹	9 ¹	8 ³	6	6	8+	7	9	FG
Raptor (5 fl oz)	2	6	9	8	8+	7	8+	9 ¹	9 ¹	8 ³	8	6	8	7	9	G
Reflex/Flexstar (1.25 pt)	14	7	8	9	6	8	8+	9	9	9	8	N	8	6	7+	FG
Resource (6 fl oz)	14	6	6	7	7	N	8	7+	7+	7+	6	6	6	6	9+	FG
Ultra Blazer (1.5 pt)	14	7	8	9	7	8	8	9	9	9	8	N	8+	6	7+	F
Mixtures																
Extreme (3 pt) ⁴	2/9	8	9	9	8+	7+	8	9 ^{1,2}	9	8+ ^{2,3}	8	7	8+	8+	9	VG
Flexstar GT (4.5 pt) ⁴	9/14	8+	9	9	8+	8	8	9 ²	9	9 ²	9	8	8+	9	8+	F
Permit Plus (0.75 oz) ⁵	2/2	7	9	7	9	6	6	9 ¹	9 ¹	9 ³	8	7	9	—	9	— ⁶
Storm (1.5 pt)	6/14	6	8	9	7	7+	7	8+	8+	8+	7	7	8+	8	8	FG
Synchrony (0.75 oz) ⁵	2/2	8+	9+	9	9	7	N	9+ ¹	9+ ¹	8 ³	7+	N	9	N	9	— ⁶

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Resistance to: Glyphosate (9) ALS (2)

Herbicides (rate/A)	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth/Waterhemp ^{1,2}	Pigweed ¹	Ragweed, Common ^{2,3}	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Injury
Basagran (1 qt)	6	N	9	9	8	N	N	6	6	8	7	8	9	8+	8+	FG
Cadet (0.9 oz)	14	N	N	N	7	7	7	7	7	N	N	7	N	7	9+	F
Cobra (12.5 fl oz)	14	8	8	9	7	8	8+	9	9	9	8+	6	7	7	8+	F-
Liberty (32 fl oz) ⁷	10	8	9	9	9	8	8	8+	8+	9	8+	8	8+	7+	8	VG
Reflex/Flexstar (1.25 pt)	14	7	8	9	6	8	8+	9	9	9	8	N	8	6	7+	FG
Resource (6 fl oz)	14	6	6	7	7	N	8	7+	7+	7+	6	6	6	6	9+	FG
Ultra Blazer (1.5 pt)	14	7	8	9	7	8	8	9	9	9	8	N	8+	6	7+	F
Mixtures																
Flexstar GT (4.5 pt) ⁴	9/14	8+	9	9	8+	8	8	9 ²	9	9 ²	9	8	8+	9	8+	F
Storm (1.5 pt)	6/14	6	8	9	7	7+	7	8+	8+	8+	7	7	8+	8	8	FG

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Basagran (1 qt)	6	N	9	9	8	N	N	6	6	8	7	8	9	8+	8+	FG
Cadet (0.9 oz)	14	N	N	N	7	7	7	7	7	N	N	7	N	7	9+	F
Cobra (12.5 fl oz)	14	8	8	9	7	8	8+	9	9	9	8+	6	7	7	8+	F-
Liberty (32 fl oz) ⁷	10	8	9	9	9	8	8	8+	8+	9	8+	8	8+	7+	8	VG
Reflex/Flexstar (1.25 pt)	14	7	8	9	6	8	8+	9	9	9	8	N	8	6	7+	FG
Resource (6 fl oz)	14	6	6	7	7	N	8	7+	7+	7+	6	6	6	6	9+	FG
Ultra Blazer (1.5 pt)	14	7	8	9	7	8	8	9	9	9	8	N	8+	6	7+	F
Mixtures																
Flexstar GT (4.5 pt) ⁴	9/14	8+	9	9	8+	8	8	9 ²	9	9 ²	9	8	8+	9	8+	F
Storm (1.5 pt)	6/14	6	8	9	7	7+	7	8+	8+	8+	7	7	8+	8	8	FG

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Resistance to:
Glyphosate (9)
ALS (2)
PPO (14)

Herbicides (rate/A)	Herbicide Group (Mode of Action)	Burcucumber	Cocklebur	Jimsonweed	Lambsquarters	Morningglory, Annual	Nightshade, Eastern Black	Palmer Amaranth/Waterhemp ^{1,2}	Pigweed ¹	Ragweed, Common ^{2,3}	Ragweed, Giant	Sida, Prickly	Smartweed	Spurred Anoda	Velvetleaf	Soybean Injury
Basagran (1 qt)	6	N	9	9	8	N	N	6	6	8	7	8	9	8+	8+	FG
Liberty (32 fl oz) ⁷	10	8	9	9	9	8	8	8+	8+	9	8+	8	8+	7+	8	VG
Mixtures																

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Amaranth Identification

Palmer Amaranth	Common Waterhemp	Redroot Pigweed
Ovate to diamond leaves with apex towards the petiole	Long lanceolate leaves	Round to oval leaves with apex towards the middle
No hair	No hair	Fine hairs on stem especially towards newest growth
Long petioles and rosette leaf pattern	Waxy leaf surface	Rough leaf surface





Figure 2. Hairless stems of Palmer amaranth. Stems of amaranth are hairless, stems of smooth and **redroot** pigweed are covered with hairs.



Palmer amaranth



Smooth pigweed

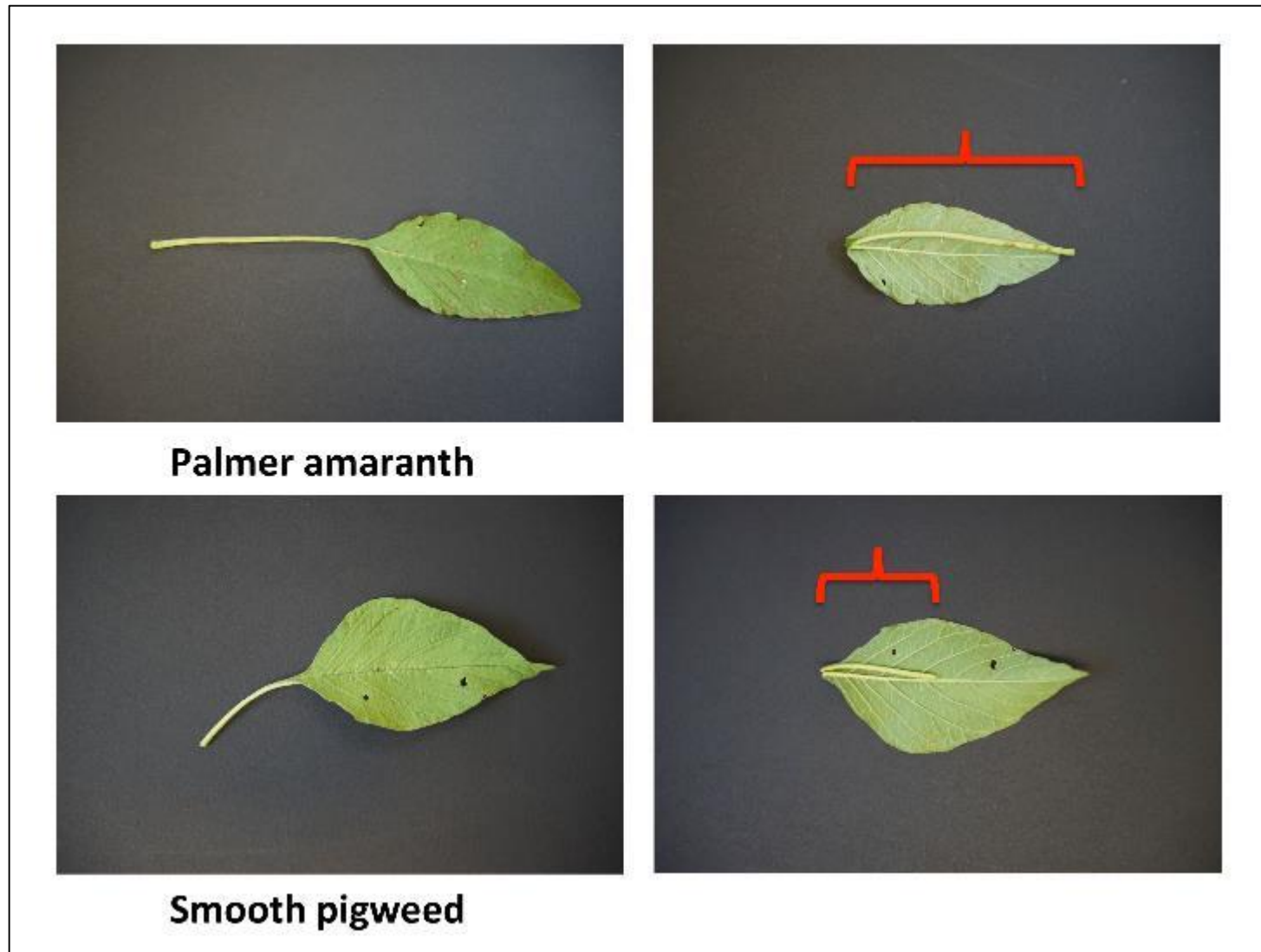


Figure 3. Palmer amaranth petioles (upper panel) are longer than the leaf blade, petiole of smooth pigweed (lower panel) are about half the length of the leaf blade.

Petiole Length

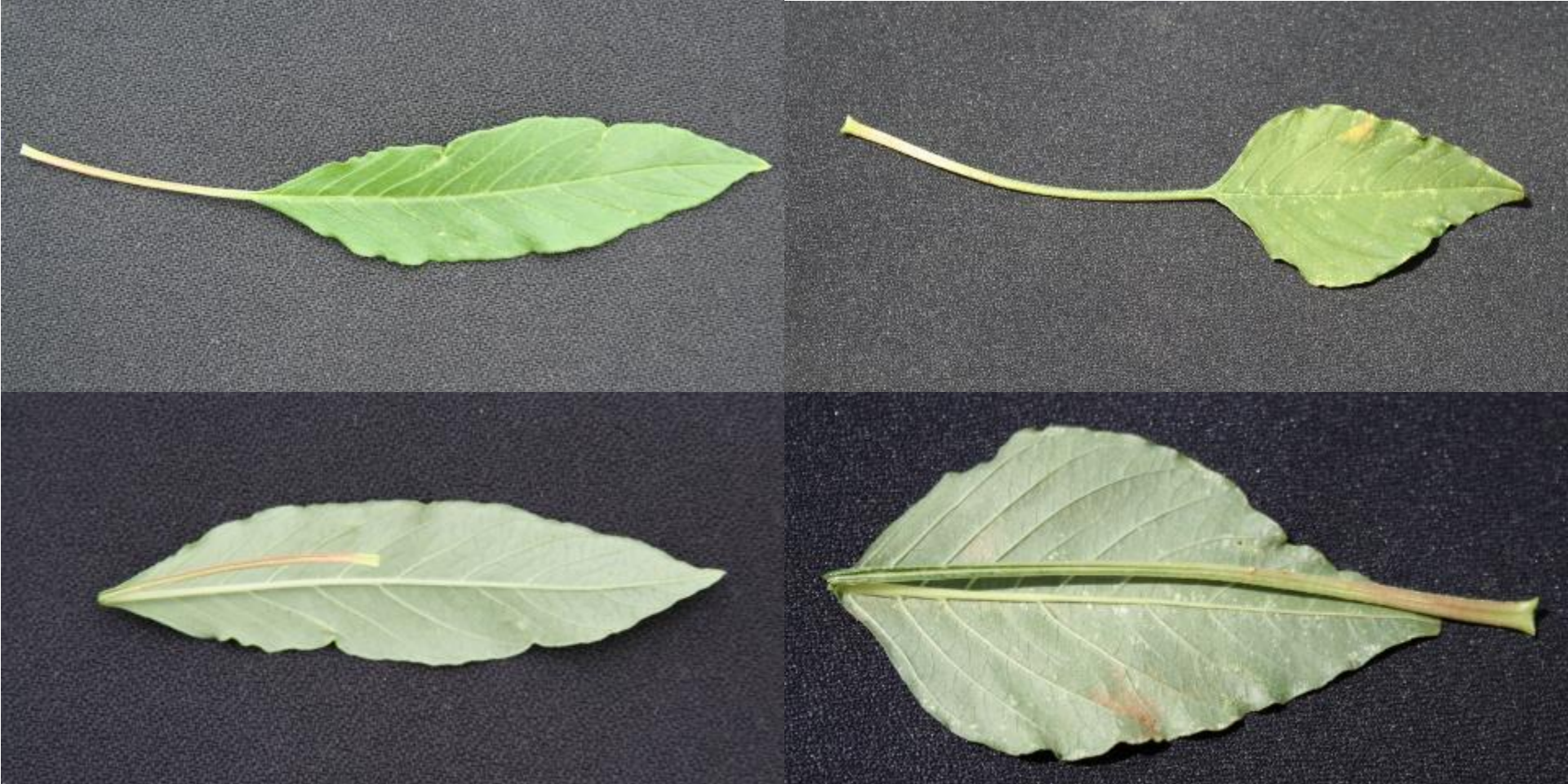
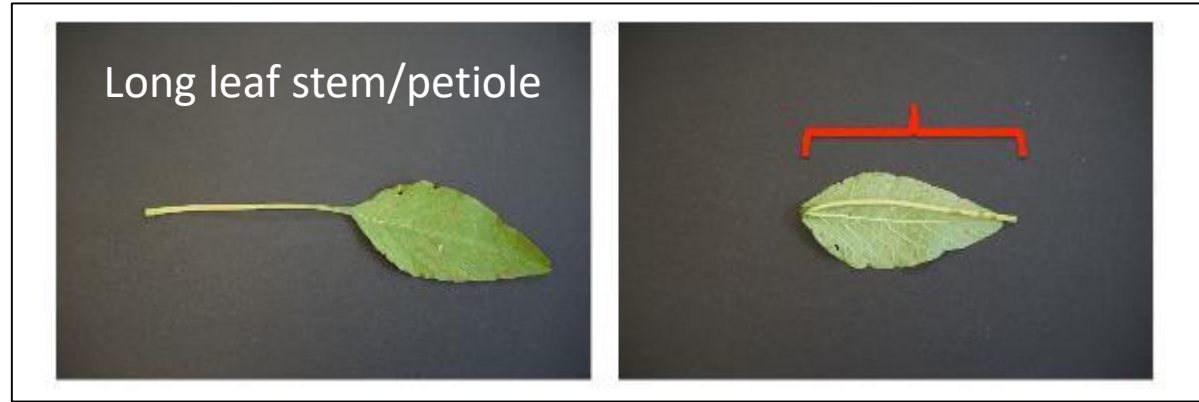




Figure 7. Palmer amaranth has male and female flowers on separate plants. The flower heads of Palmer amaranth are the *Amaranthus retrofractus* within the pigweed family (left panel). Flower heads of other pigweed species such as **smooth pigweed** are often more compact and shorter than in Palmer amaranth (**right panel**).



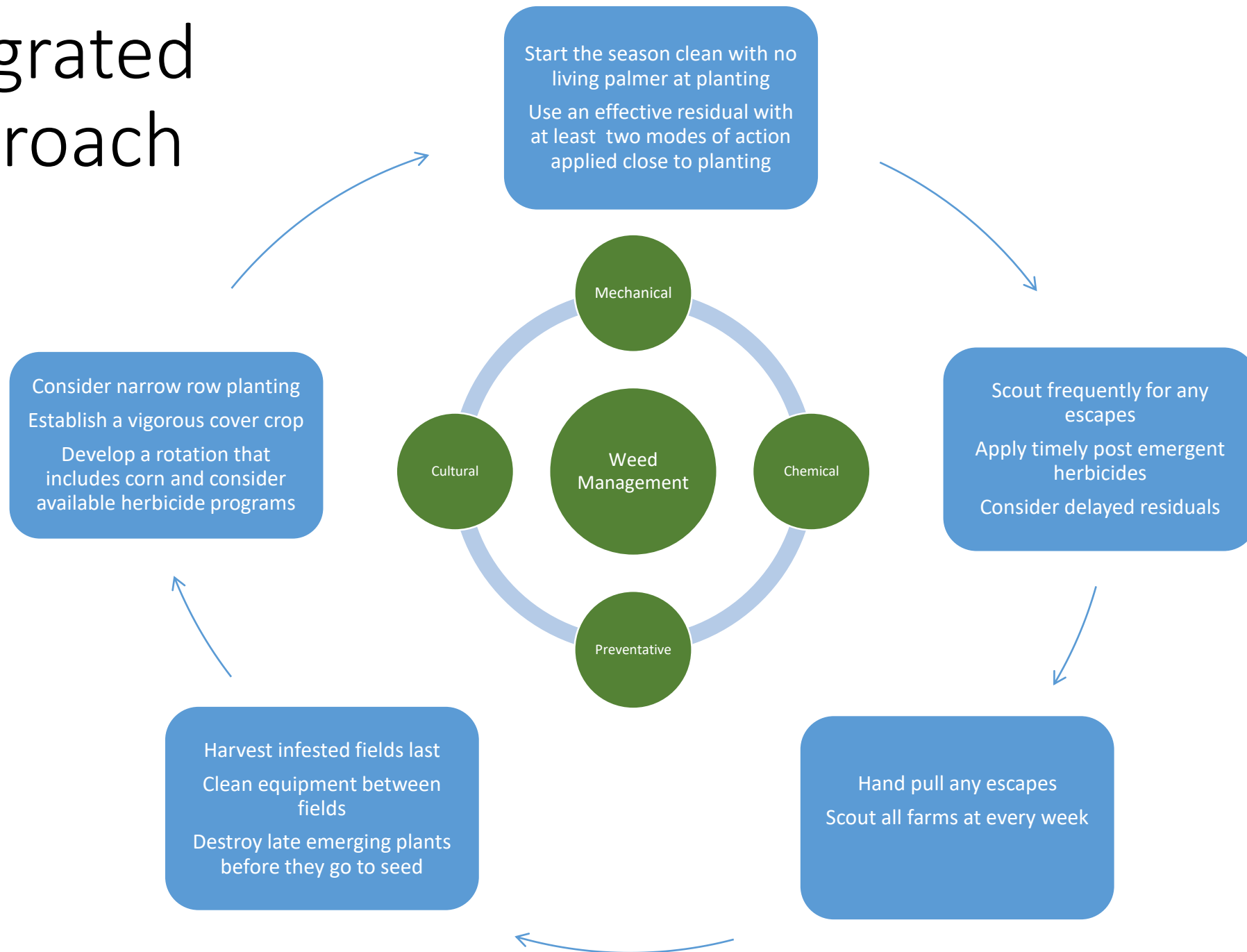
How to ID Palmer



Five Point Plan for Palmer Control in Round-Up Ready Soybeans

1. Start Clean
2. Use an effective residual herbicide at planting
3. Treat any escapes early before palmer is 4-6 inches with an effective post-emergent herbicide
4. Manage the seed-bank later in the season
5. Isolate infested fields and harvest last. Do not move equipment from infested fields to clean fields

Integrated Approach



Management of Palmer - UMD

1. Start Clean

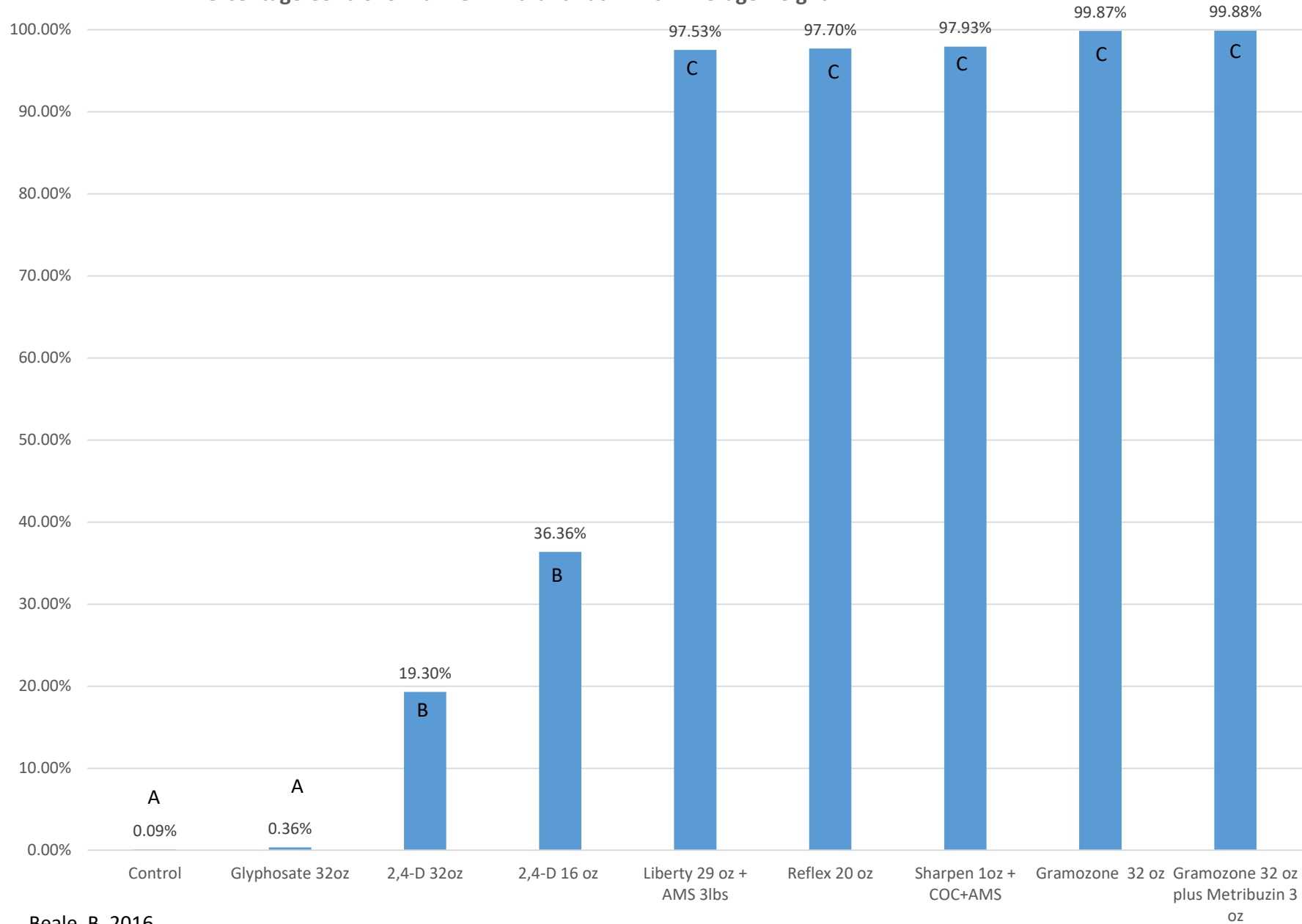
- Fields should be clean of all Palmer amaranth before the crop emerges.
- Options for effective post-emergent control in soybean are limited and the few options available must be used when Palmer amaranth plants are less than 4 inches tall
- Consider all weed species present and plan accordingly...marestail, common ragweed, perennial grasses, etc
- Tillage can also be effective tool to kill emerged palmer plants

Management of Palmer - UMD

1. Start Clean-Sample Plan

- Burn down cover crop with 1 pint 2,4-D + 1 quart of glyphosate in early April.
 - 2,4-D should pick up any marestail. Palmer will begin to emerge in late April. Recent research shows that a heavy cover crop will suppress palmer germination, thus another option is to terminate cover crop late.
- At planting – Apply Gramoxone at 1.5 pts to 1 quart per acre in at least 20 gallons of water
 - Gramoxone® is an effective burn down treatment for smaller plants provided it is applied with adequate water and coverage is good.
 - If planting is delayed, a secondary application of Gramoxone may be needed to prevent palmer from getting beyond the 4-6 inch zone.
 - If perennial weeds or grasses are present that Gramoxone wont control, a tankmix program or Roundup followed by Gramoxone may be needed.

Percentage Control of Palmer Amaranth at 4 inch Average Height







Management of Palmer - UMD

2. Use an effective residual herbicide at planting

- Trials show good results from:
 - Products with flumioxazin (Valor) including premixes of Fierce or Fierce XLT
 - Products with sulfentrazone (Authority) including premixes Broadaxe, Authority Elite, Authority MTZ
- Residuals provide two benefits:
 - Reduce the number of weeds present
 - Allow a wider window for timely control with post products



Valor

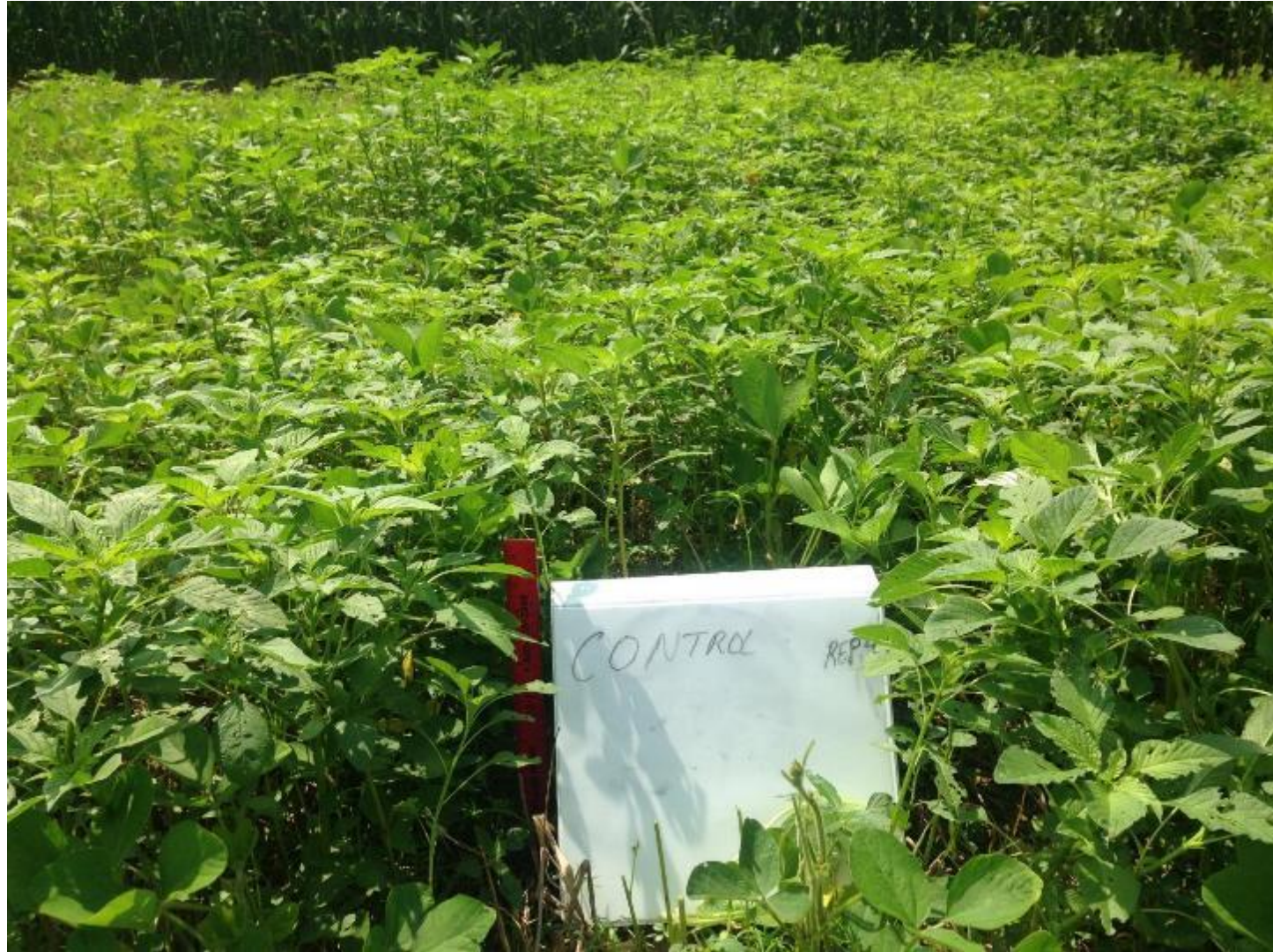
Control

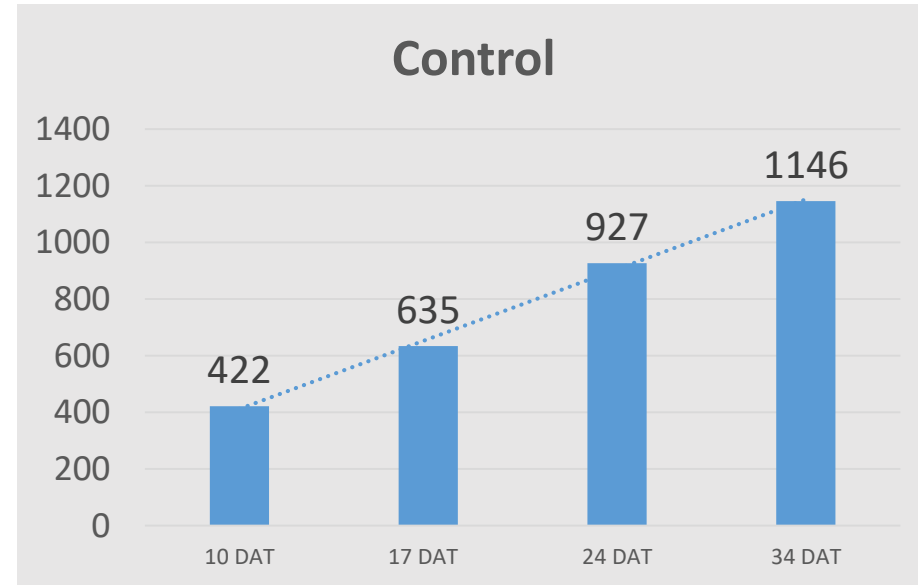
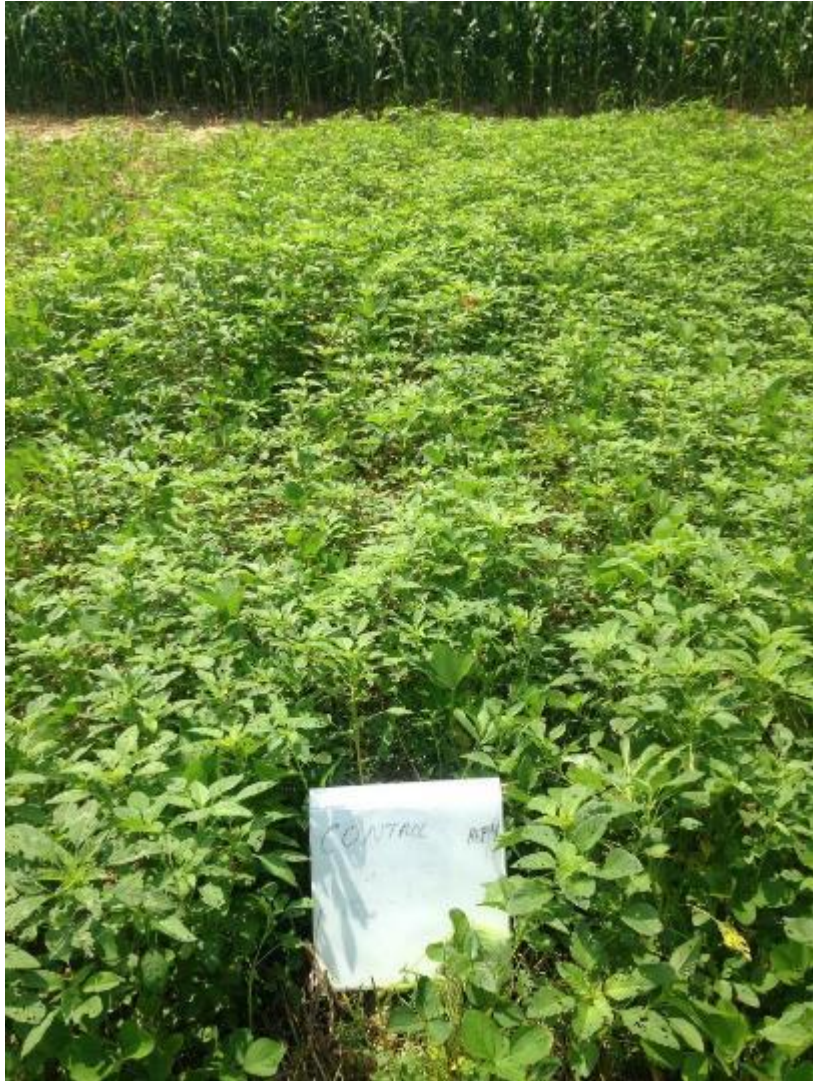


Control Plots: Palmer
amaranth 17 days after
planting



Same control plot 24 days after planting. At this point, post emergent application will be ineffective.

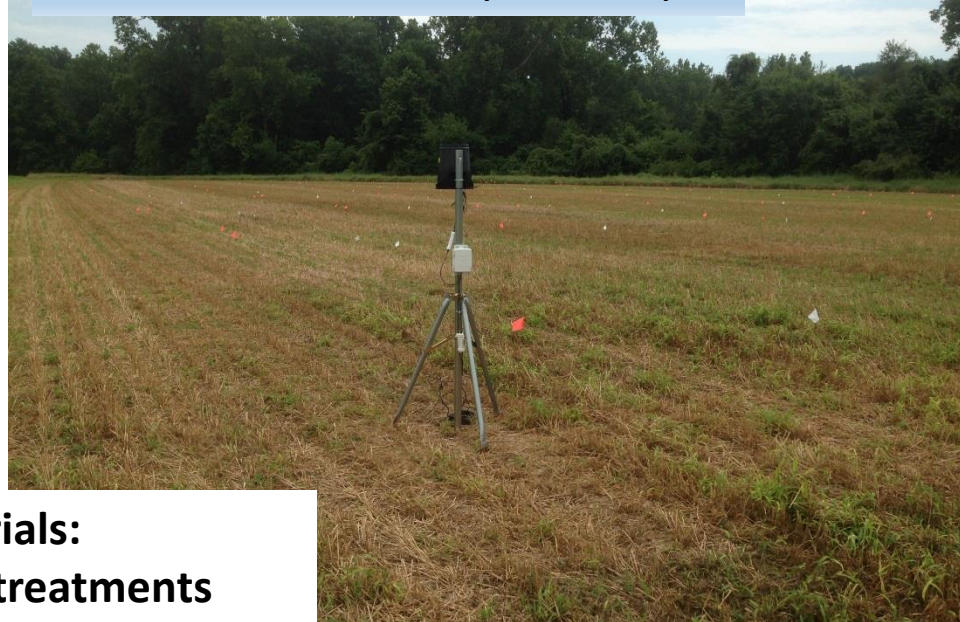




2017 Location -Charles County



2017 Location St. Mary's County



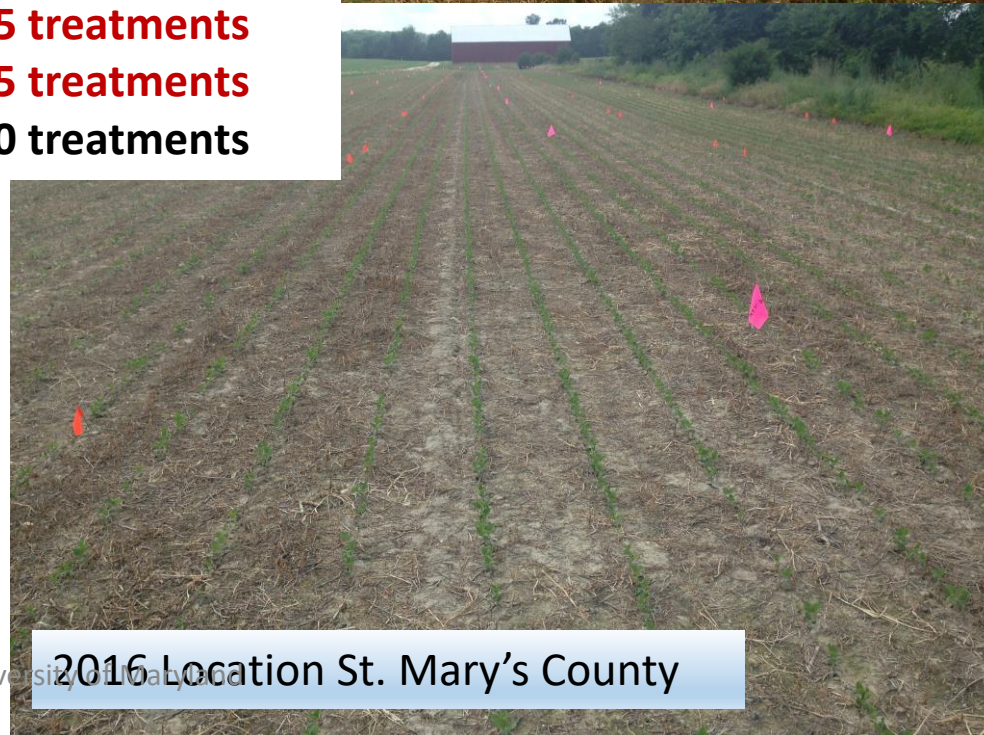
Residual Herbicide Trials:

2015:	1 location	8 treatments
2016:	2 locations	15 treatments
2017:	2 locations	15 treatments
2018:	2 Locations	20 treatments

2016 Location -Charles County



2016 Location St. Mary's County



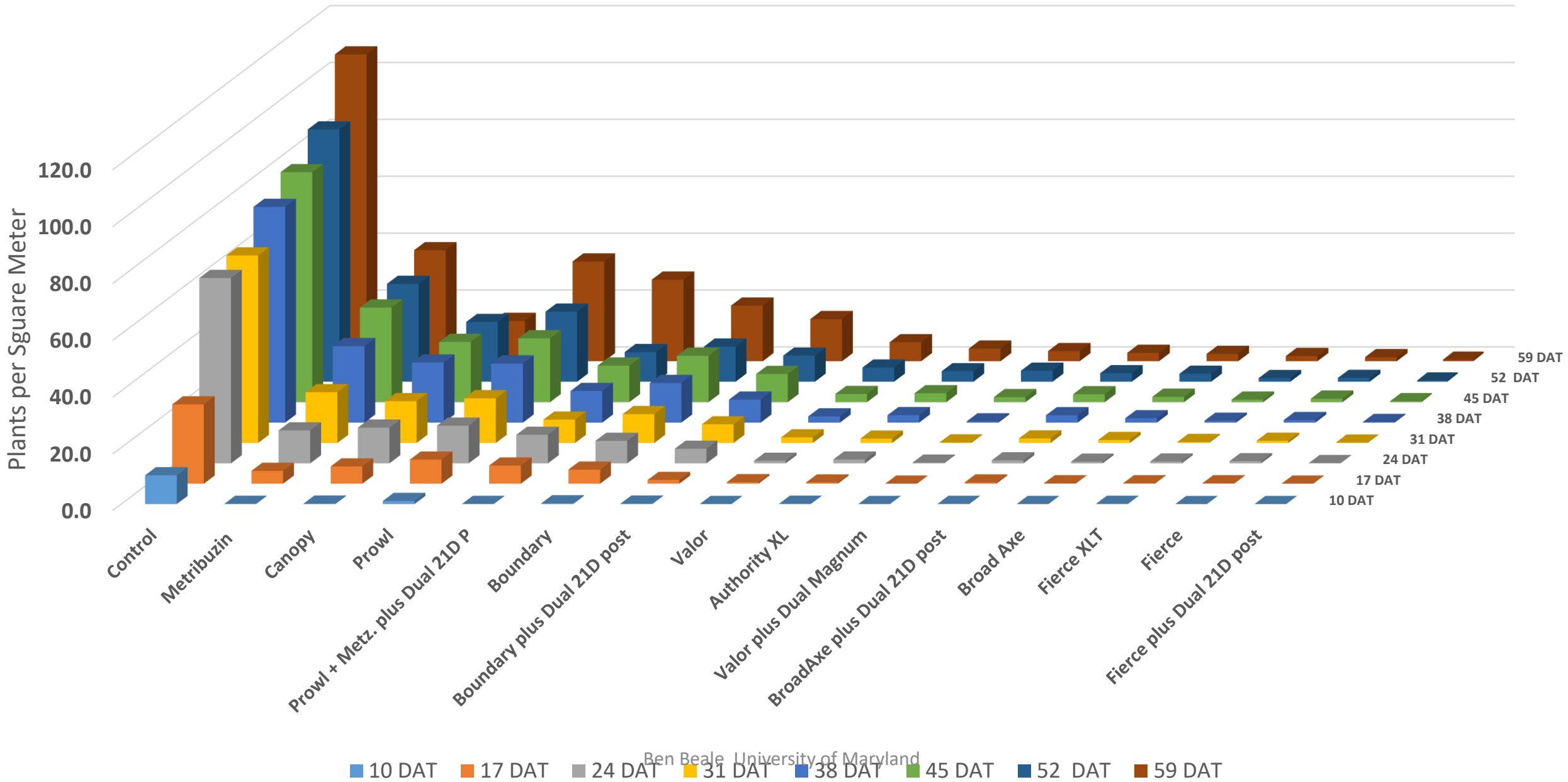
Treatment #	Treatment and Rate	Common Name	Equivalent To
1	Control		No herbicide applied
2	4 oz Canopy	(metribuzin + chlorimuron)	3.43 ozs metribuzin 75DF 1.71 ozs Classic
3	3 oz Valor SX + 1.33 pts Dual Magnum (Off Label-Research use only)	(flumioxazin + s-metachlor)	3 oz Valor SX 1.33 pts Dual Magnum
4	3 oz Valor SX	(flumioxazin)	3 oz Valor SX
5	4 oz Authority XL	(sulfentrazone + chlorimuron)	5 oz Spartan 1.25 ozs Classic
6	25 oz BroadAxe XC	(sulfentrazone + s-metolachlor)	5.5 oz Spartan 1.47 pts Dual Magnum
7	1.25 pts Boundary	(s-metolachlor + metribuzin)	.82 pints Dual Magnum 4.2 ozs Metribuzin 75DF
8	4 oz Dimetric	(metribuzin)	4.0 ozs Metribuzin 75DF
9	1.5 pts Prowl H2O	Pendimethalin	1.5 pts Prowl H2O
10	3.75 oz Fierce	(flumioxazin + pyroxasulfone)	2.5 oz Valor SX 1.9 ozs Zidua
11	4 oz Fierce XLT	(flumioxazin + pyroxasulfone + chlorimuron)	1.91 oz Valor SX 1.49 ozs Zidua 1.06 oz Classic
12	25 oz BroadAxe XC (1.33 pts Dual 21 Days Post)	(sulfentrazone + s-metolachlor)	5.5 oz Spartan 1.47 pts Dual Magnum
13	3.75 oz Fierce (1.33 pts Dual 21 Days Post)	(flumioxazin + pyroxasulfone)	2.5 oz Valor SX 1.9 ozs Zidua
14	1.25 pts Boundary Pre (1.33 pts Dual 21 Days Post)	(s-metolachlor + metribuzin)	.82 pints Dual Magnum 4.2 ozs Metribuzin 75DF
15	1.5 pts Prowl H2O + 4 oz Dimetric (1.33 pts Dual 21 Days Post)	(pendimethalin + metribuzin)	1.5 pints Prowl H2O 4 ozs Metribuzin 75DF

Take time to understand what's in your premix!

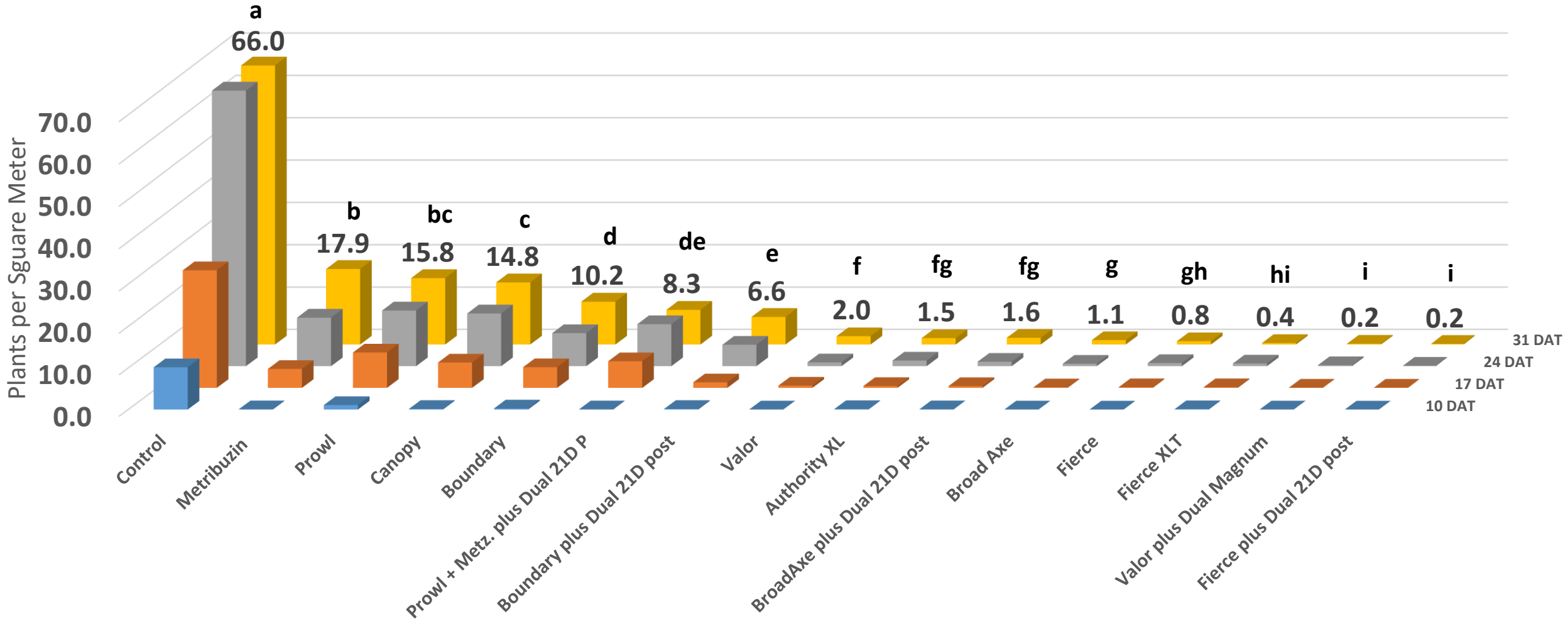
We prefer at least 2 effective modes of action.

Herbicide	Rate/A	Common Rate	MOA
Authority First / Sonic	6.5-8 oz	6	14+2
Spartan		5 fl oz	14
Pursuit		2 fl oz	2
Authority MTZ	12-16 oz	14	14+5
Spartan		5 fl oz	14
Metribuzin		5 oz	5
Authority XL	3-5 oz	4	14+2
Spartan		5 fl oz	14
Classic		1.25 oz	2
Valor SX	2-3 oz	3	14
Valor SX		3oz	14
Gangster	3.6 ozb	3	14+2
Valor SX		2.5oz	14
FirstRate		0.5oz	2
Trivence	6-10 oz	6	2+14+5
Classic		0.9 oz	2
Valor		1.5oz	14
Metribuzin		3.6oz	5
Envive	5 oz	3	2+14+2
Classic		1.1 oz	2
Valor		1.7 oz	14
Harmony		0.18oz	2
Fierce XLT	3.75-5.25 oz	3.75	14+15+2
Valor SX		1.8oz	14
Zidua		1.4oz	15
Classic		1 oz	2

Summary of Palmer Amaranth Density 10 to 59 DAT Across All Site/Years



Summary of Palmer Amaranth Density 31 DAT Across All Site/Years

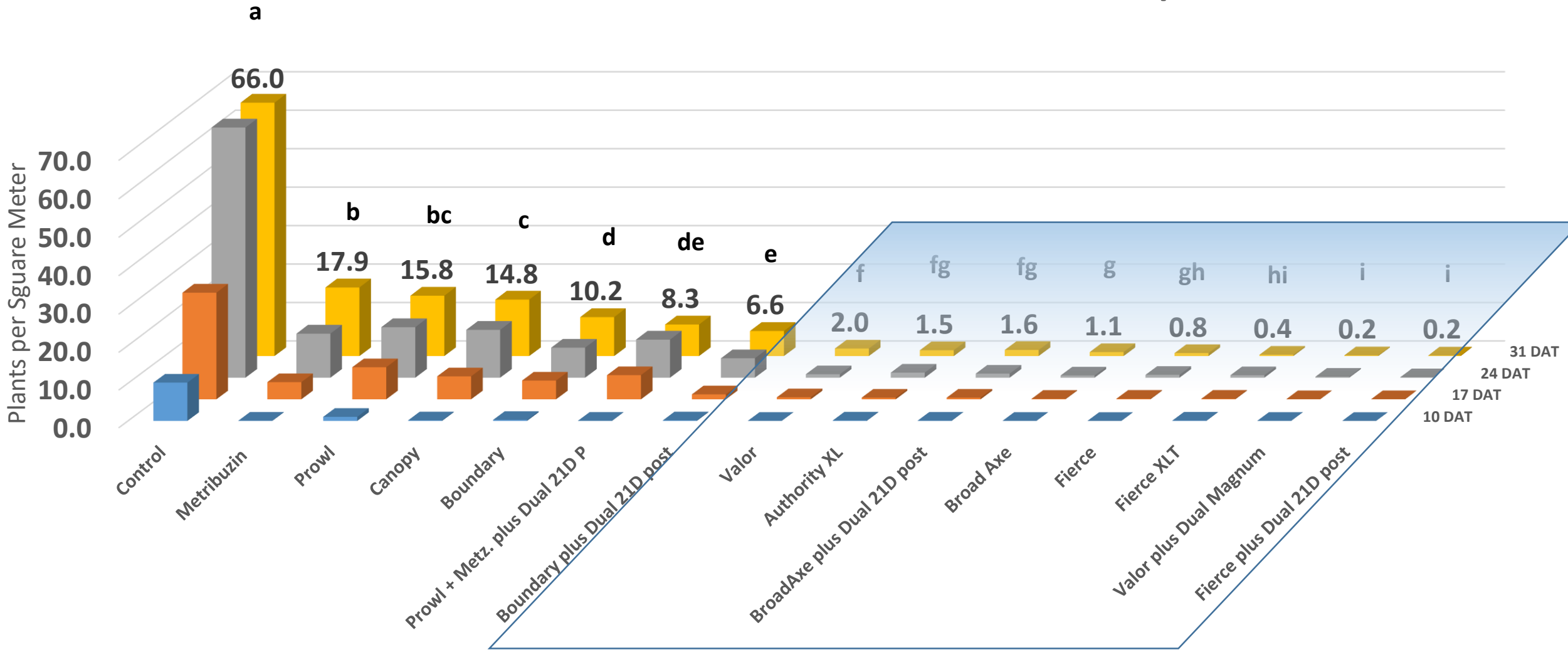


Numbers followed by different letters are significantly different at the .05 level using Tukeys HSD test

10 DAT 17 DAT 24 DAT 31 DAT

Summary of Palmer Amaranth Density 31 DAT Across All Site/Years

Products with sulfentrazone or flumioxazin performed best

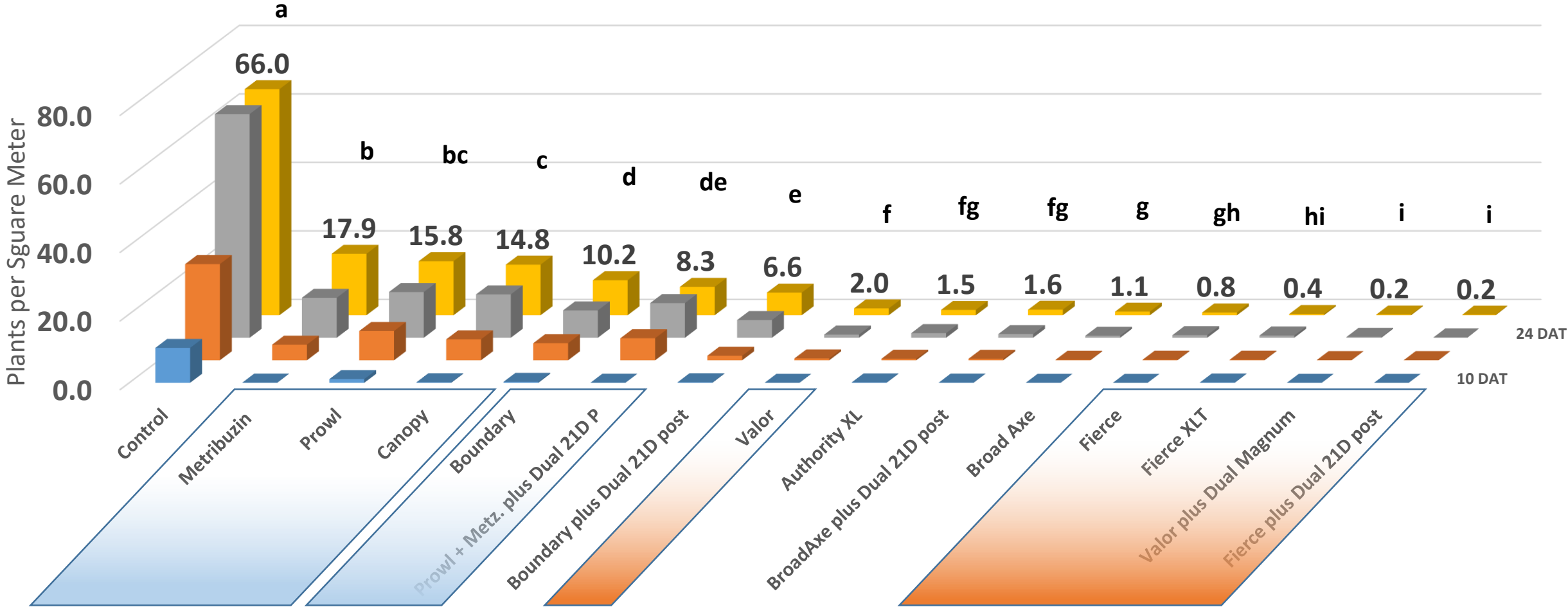


Numbers followed by different letters are significantly different at the .05 level using Tukeys HSD test

■ 10 DAT ■ 17 DAT ■ 24 DAT ■ 31 DAT

Ben Beale University of Maryland

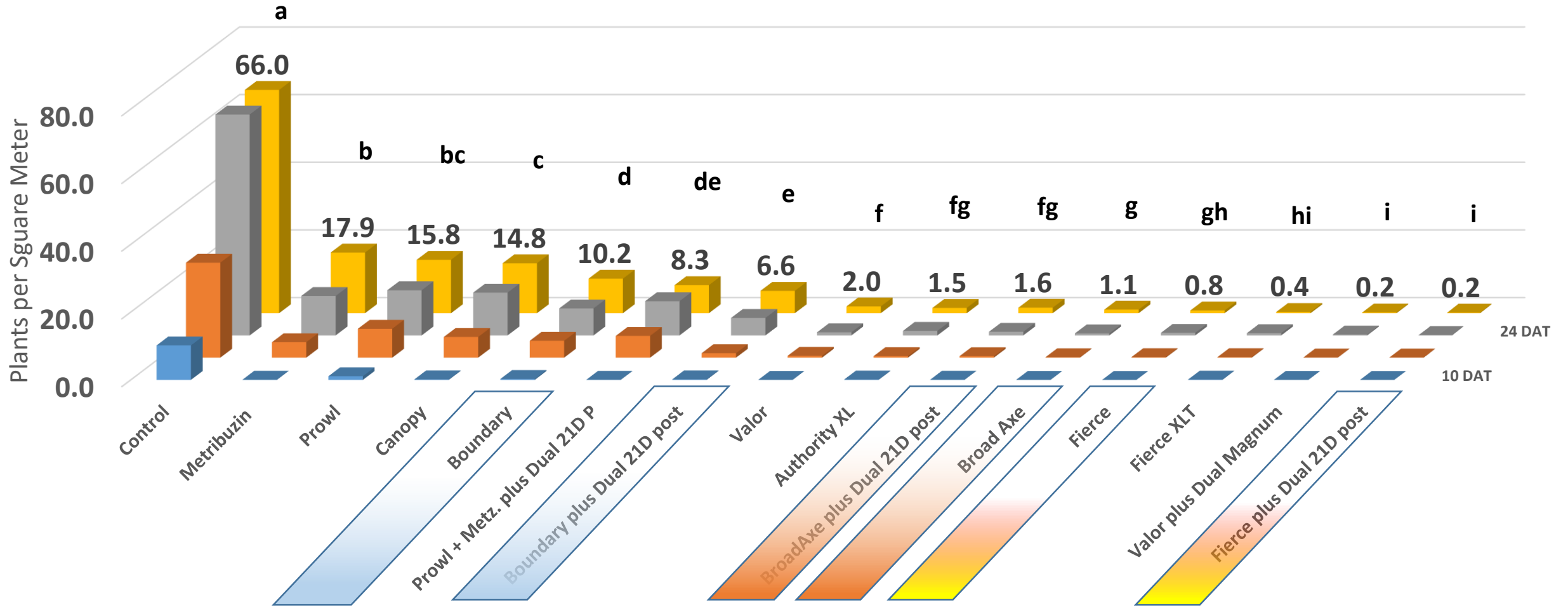
Products with at least two different effective MOA performed better than products with a single ingredient.



Numbers followed by different letters are significantly different at the .05 level using Tukeys HSD test

■ 10 DAT
 ■ 17 DAT
 ■ 24 DAT
 ■ 31 DAT

The addition of a delayed residual herbicide (s-metolachlor) applied 21 DAT decreased weed density in some cases, though not greatly.



Numbers followed by different letters are significantly different at the .05 level using Tukeys HSD test

■ 10 DAT
 ■ 17 DAT
 ■ 24 DAT
 ■ 31 DAT

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Palmer amaranth grows aggressively, requiring timely application of postemergent herbicides for effective control.



Control Plots: Palmer amaranth 17 days after planting



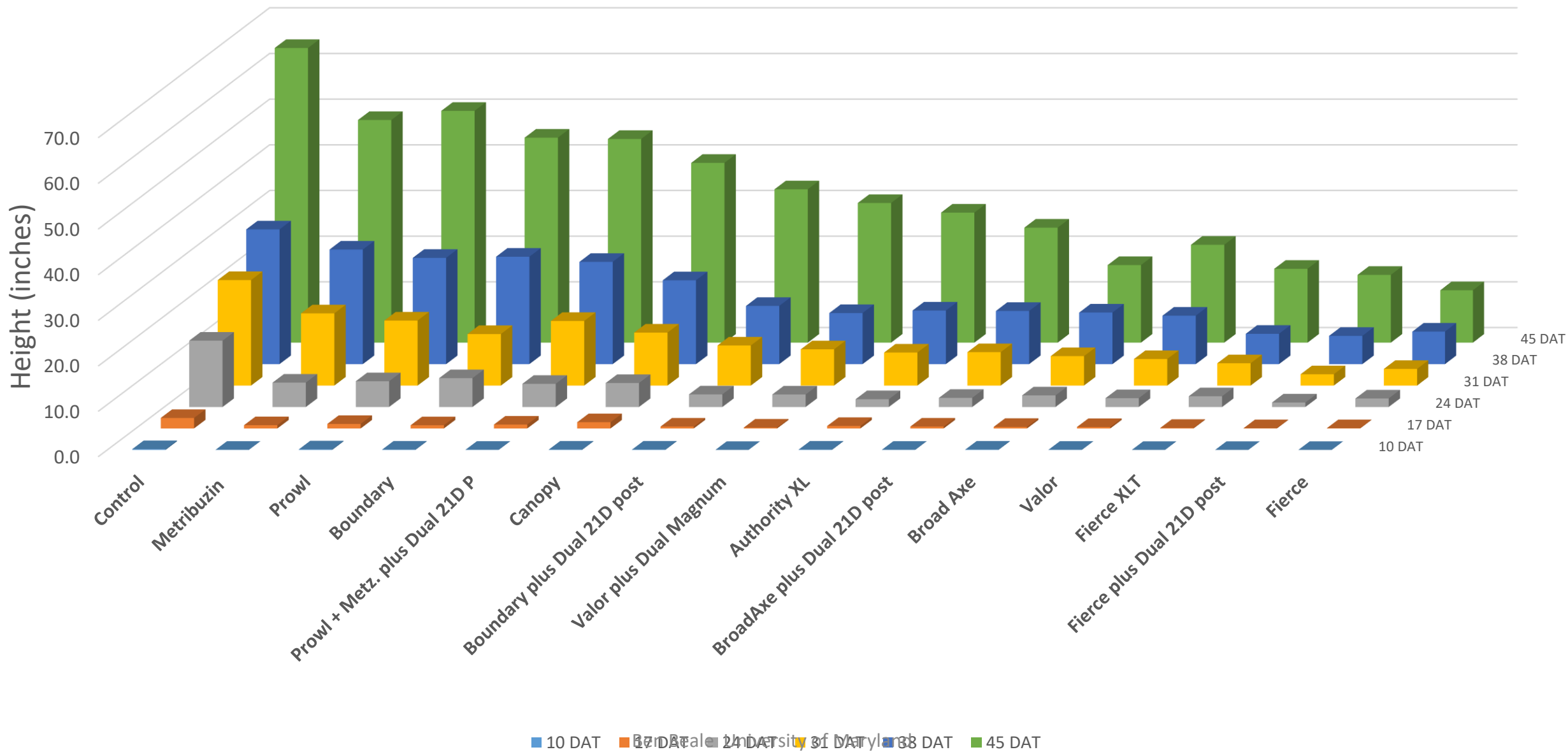
Same control plot 24 days after planting. At this point, postemergent applications will be ineffective.



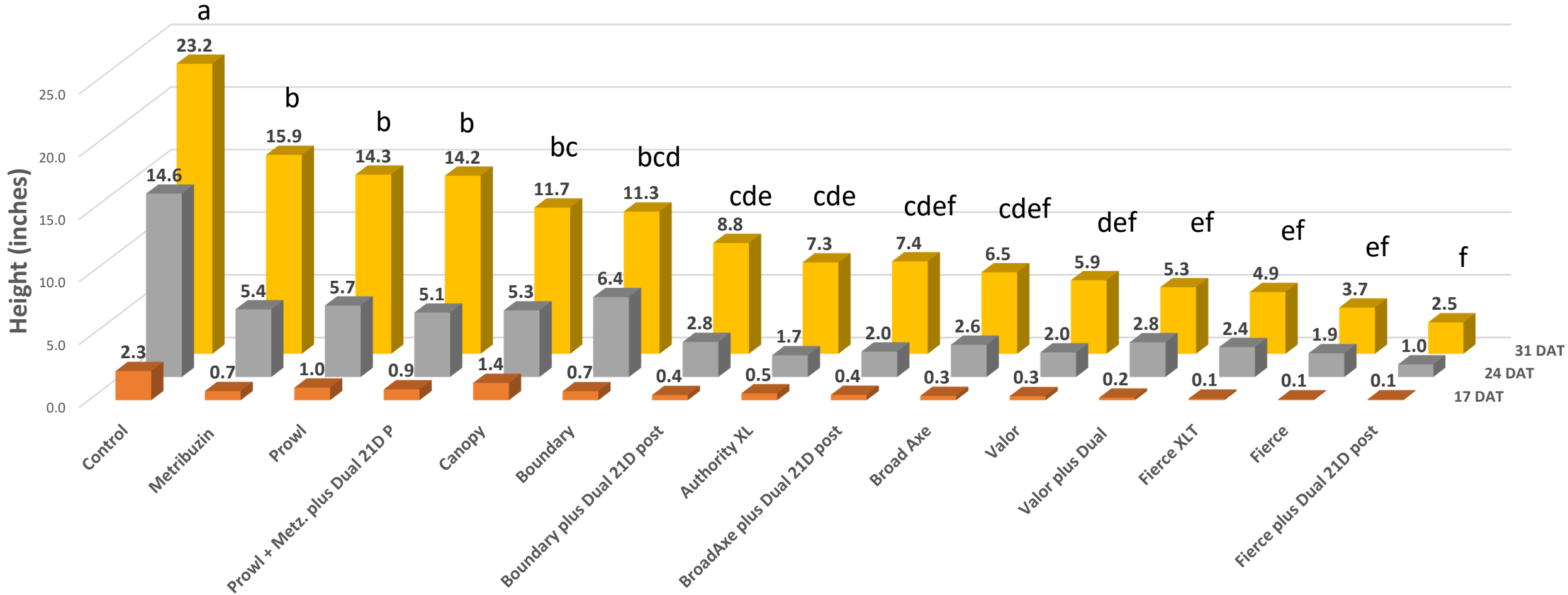
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Same control plot 35 days after planting.

Palmer Amaranth Height Averaged Across all Sites/Years

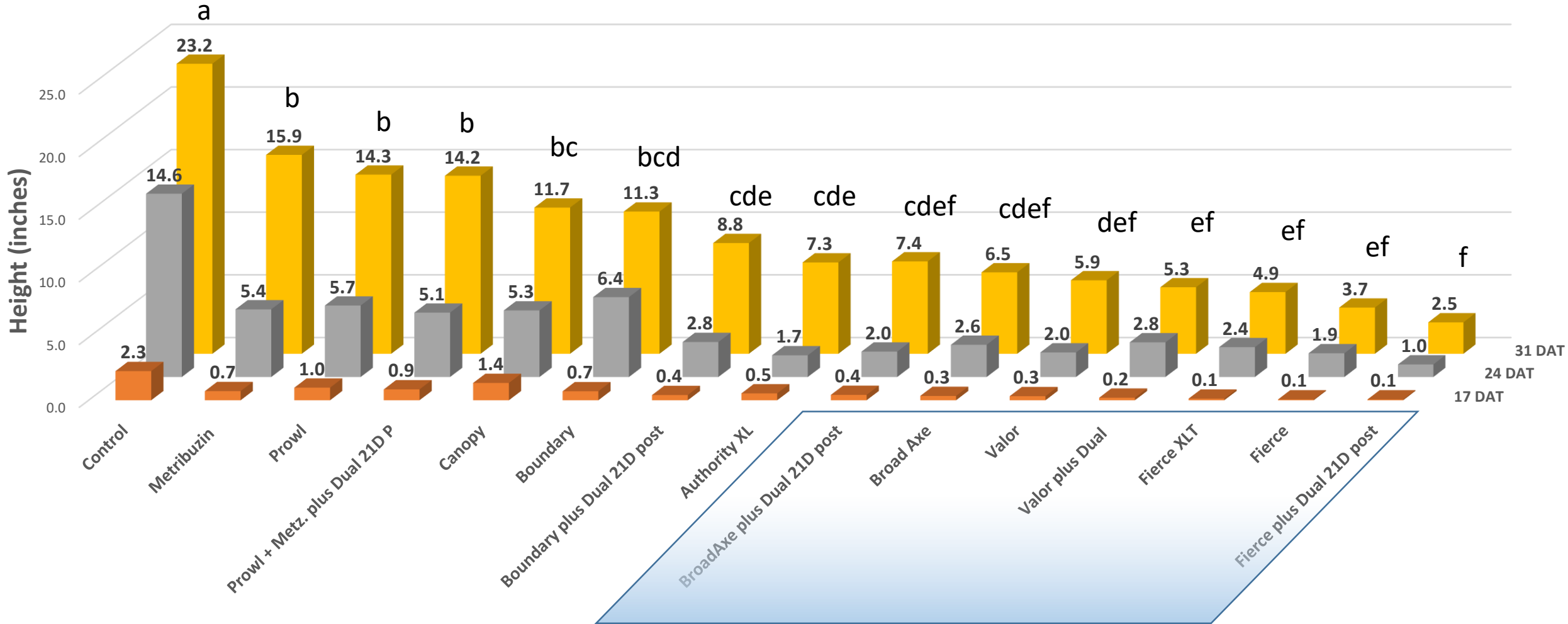


Palmer Amaranth Height at 31 DAT Averaged Across all Sites/Years



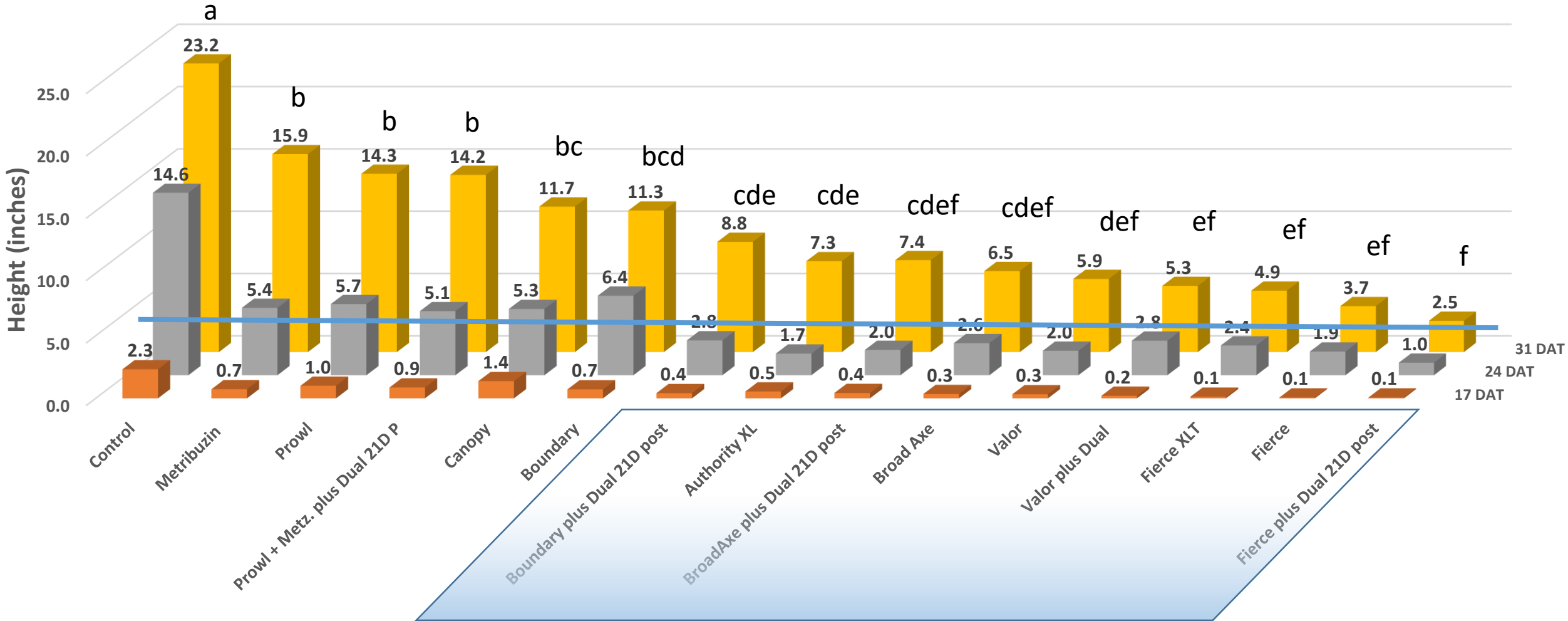
Numbers followed by different letters are significantly different at the .05 level

Palmer Amaranth Height at 31 DAT Averaged Across all Sites/Years



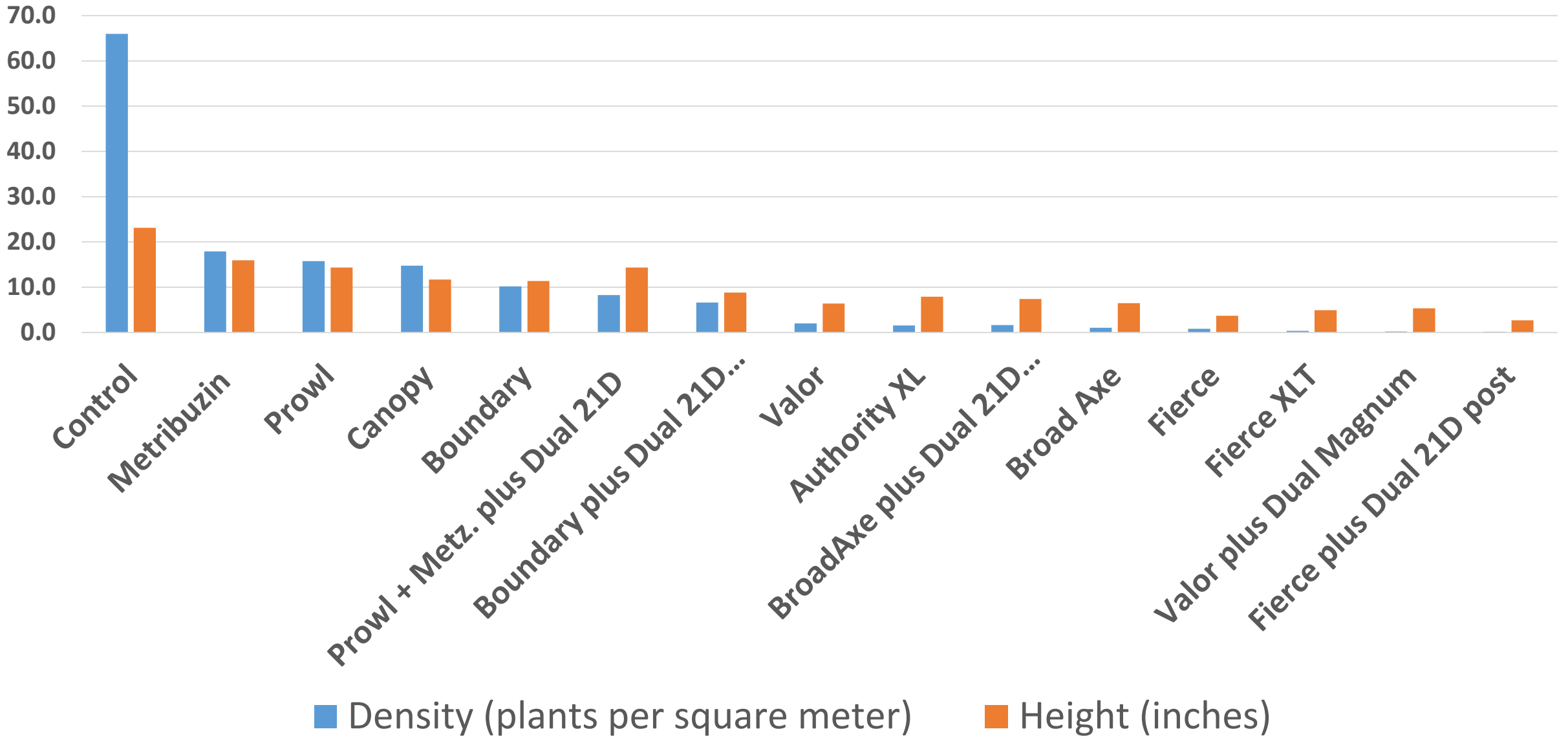
Numbers followed by different letters are significantly different at the .05 level

Palmer Amaranth Height at 31 DAT Averaged Across all Sites/Years



Numbers followed by different letters are significantly different at the .05 level

Effect of Residual Herbicides on Palmer Amaranth Growth and Density 31 DAT



Use an effective residual herbicide at planting

- Trials show good results from:
 - Products with flumioxazin (Valor) including premixes such as Fierce or Fierce XLT
 - Products with sulfentrazone (Authority) including premixes such as Broadaxe, Authority Elite, Authority MTZ
- Use at least two effective modes of action
 - PPO (Group 14) (Valor, Authority)
 - Photosystem Inhibitor (Group 5) metribuzin
 - VLCFA (Group 15) (Dual, Zidua, Warrant)
- Residuals provide two benefits:
 - Reduce the number of weeds present
 - Allow a wider window for timely control with post products

Postermergent Products:

- Fomesafan (Group 14 PPO)
 - Flexstar GT applied at full allowable rate
 - Reflex plus Glyphosate at full allowable rate
 - Can only use once every two years in MD
 - At least 20 gallons of water-coverage is critical
 - Should use a surfactant plus AMS
- Other PPO products include Cobra or Blazer
- Herbicide Tolerant Traits
 - Xtend
 - Liberty
 - Enlist

 **Flexstar[®]GT3.5**

 **Reflex[®]**

LIBERTY
LINK[®] 

ROUNDUP READY 2
X[™]TEND[™]
SOYBEANS

NOW COMMERCIALLY AVAILABLE



Management of Palmer - UMD

4. Manage the seed bank

- Palmer plants produce a lot of very small seeds- up to ½ million per plant without competition
- Palmer Amaranth can also produce seeds quickly-meaning plants germinating in August or September can still produce seeds for the next growing season
- Key steps:
 - Destroy any late germinating palmer plants in harvested corn or soybean fields.
 - Physically pull, bag and remove plants from newly infested fields.
 - Consider destroying part of a crop if Palmer is only in one section of the field.

Management of Palmer - UMD

- Our experience in Maryland is Palmer is spread from field to field mostly by the combine.
- Seed can also move easily with anything that carries soil-wildlife, tractor tires, implements, etc...
- Be careful when buying used equipment, particularly from areas with a history of palmer infestation
- Clean equipment regularly between farms. A leaf blower or high pressure air can be useful tools for this.



**Pulling plants now saves
headaches later**



**Photo credits:
A. Bradley and A. York**

Year 2



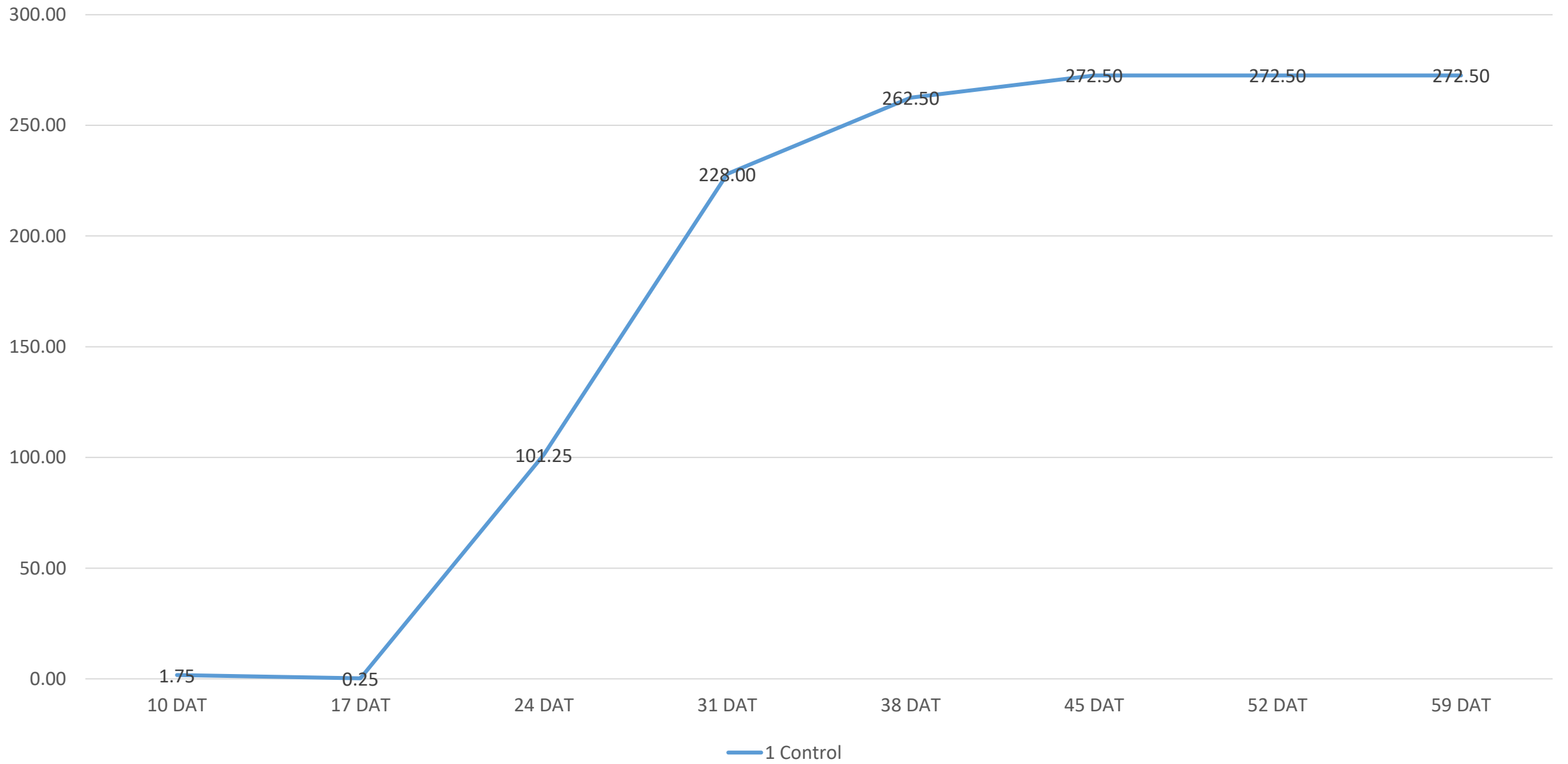
Year 3 or 4





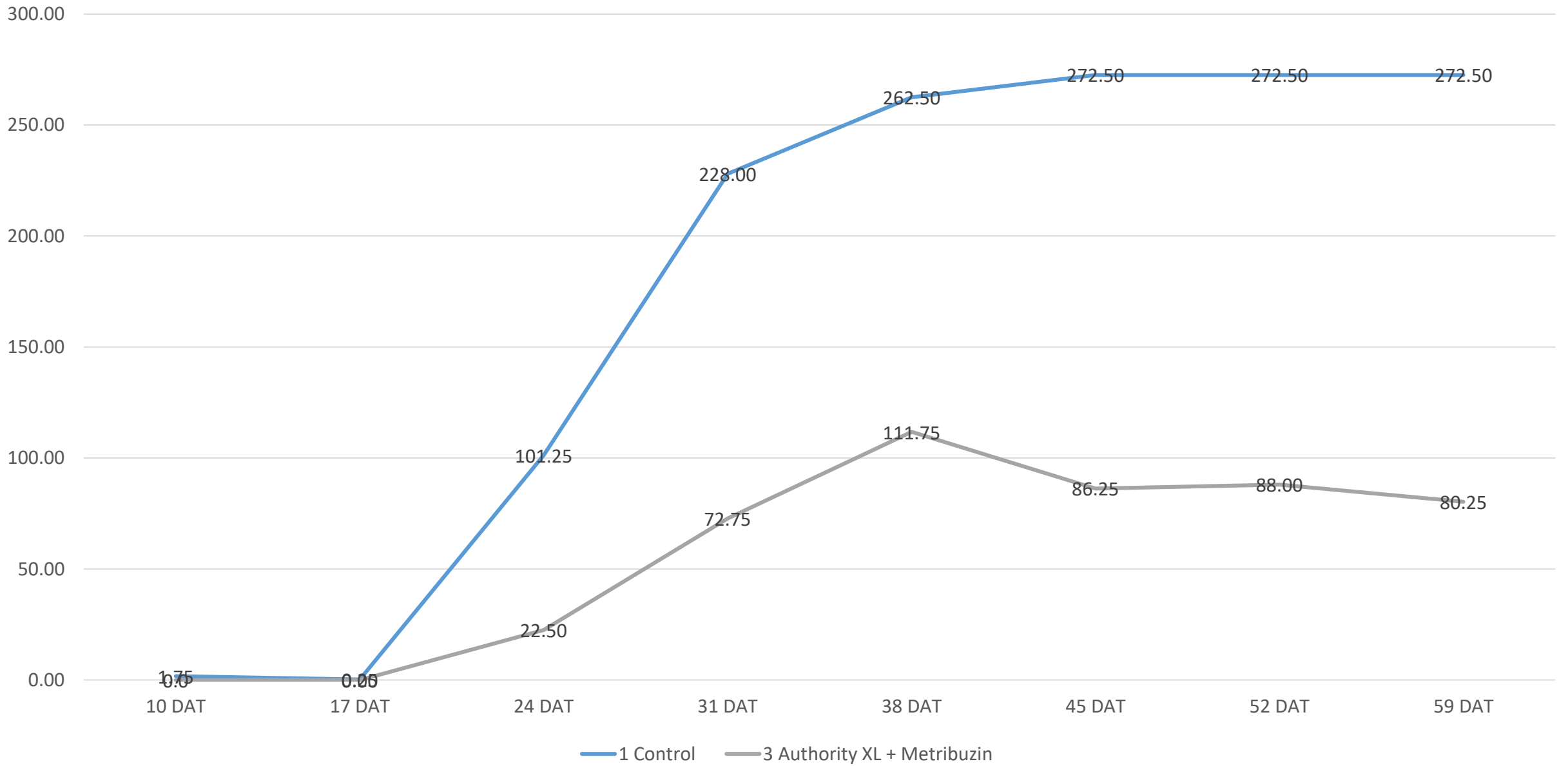


Control Plots- No Pre or Post Herbicde Applied



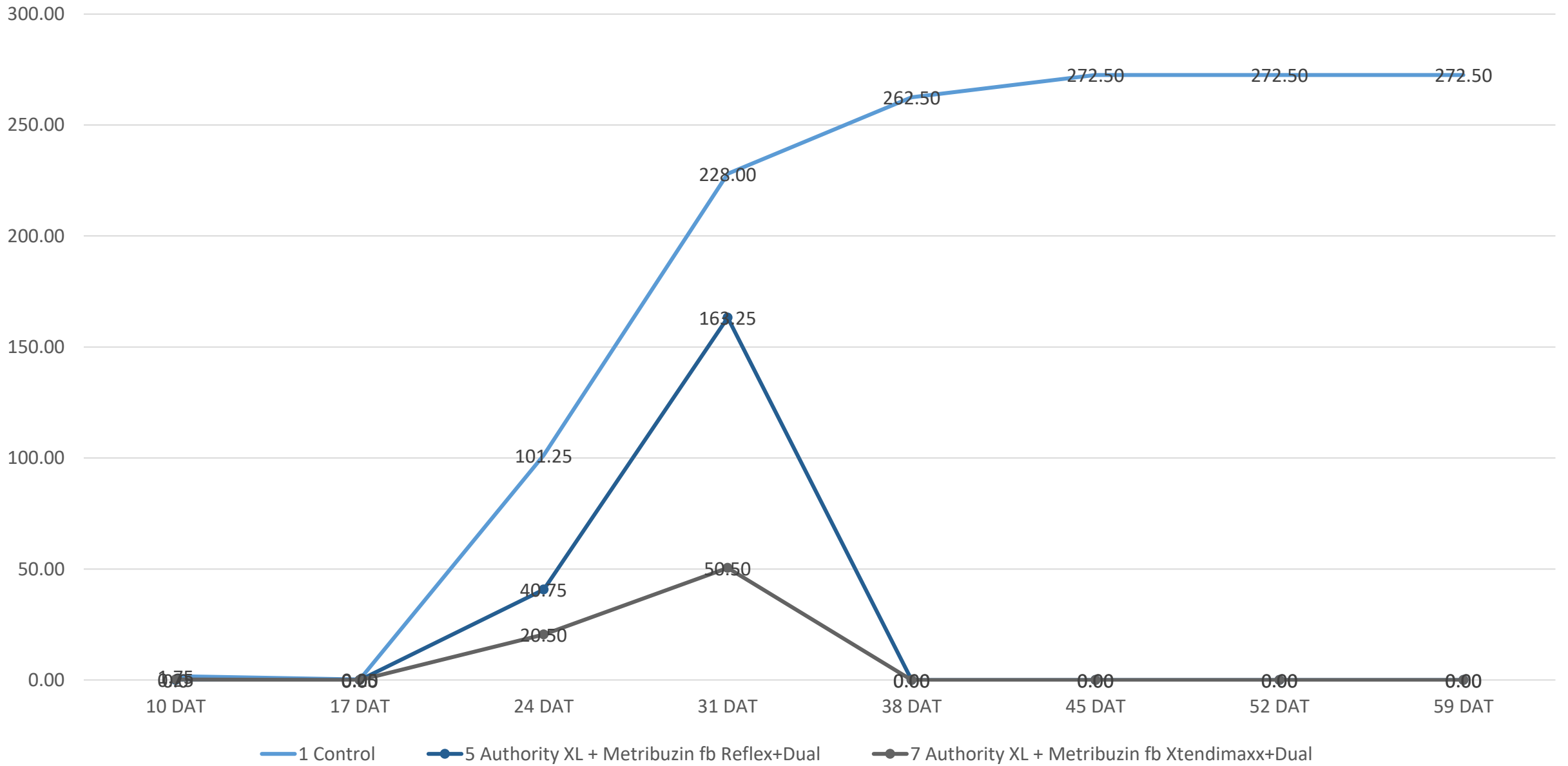


Authority XL + Metribuzin Treatment



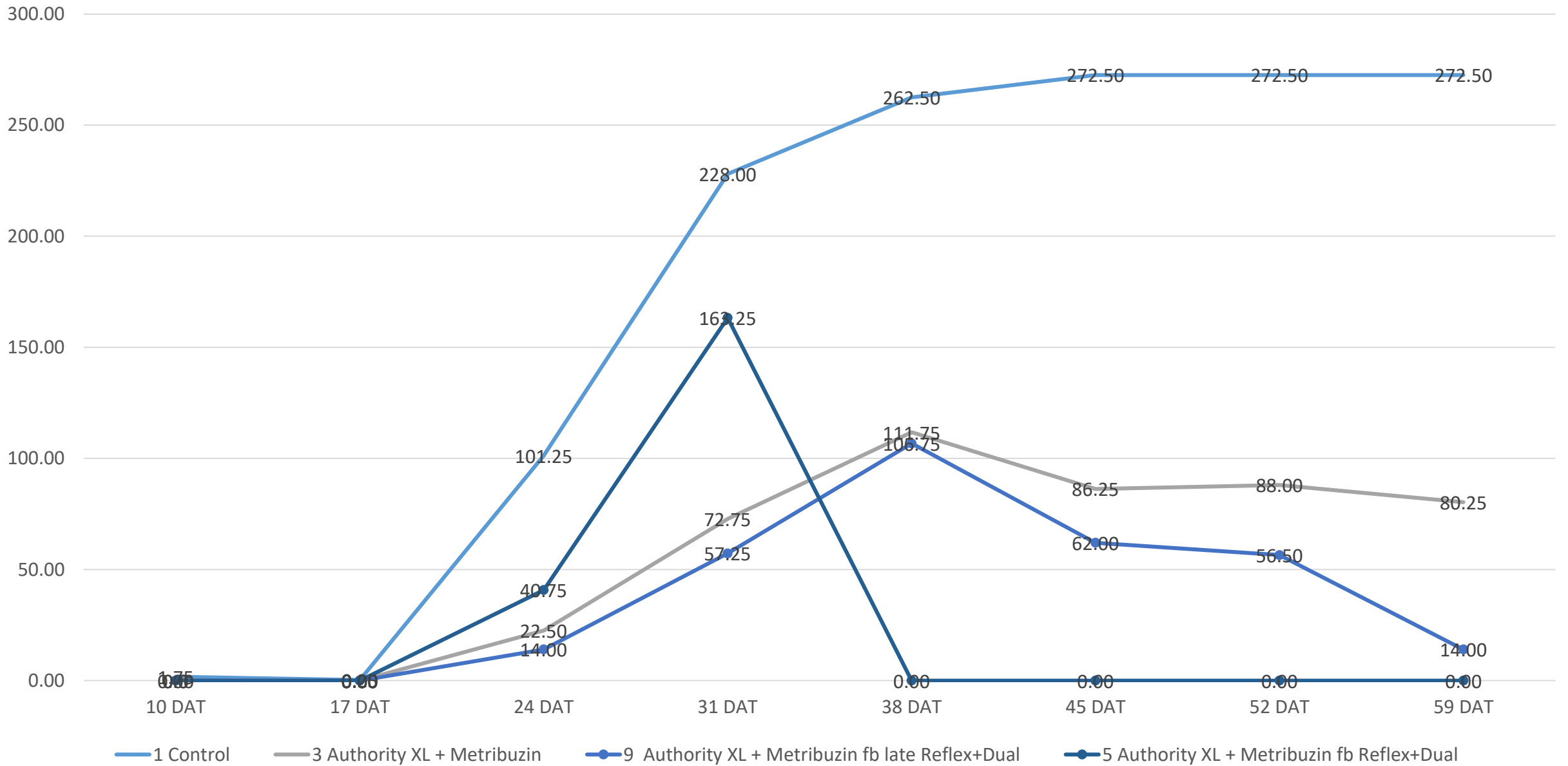


Authority XL followed by Reflex or Xtendimaxx at 24 days



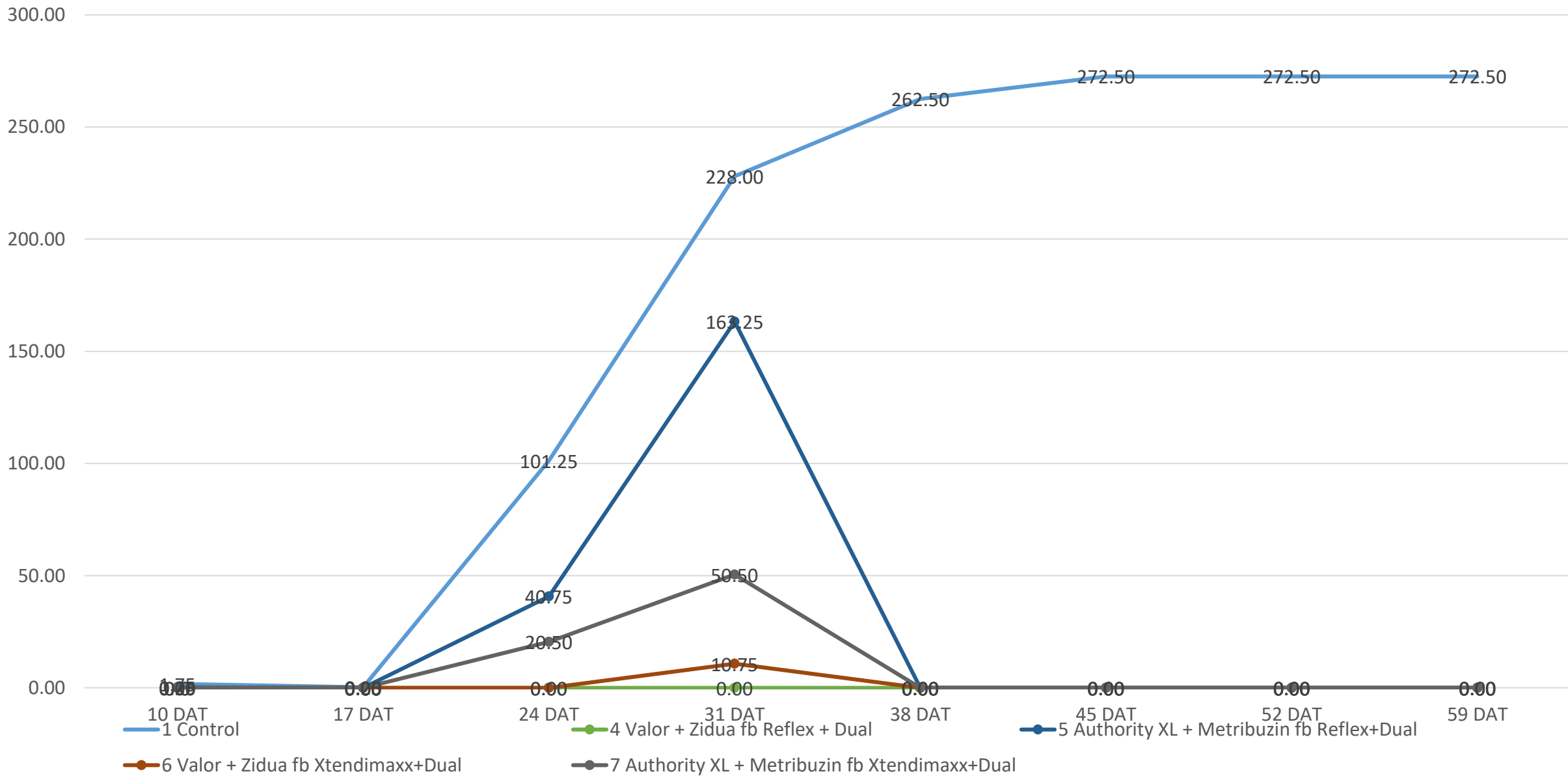


Authority Treatments followed by late Reflex Treatment





Effective Residual Treatment followed by Timely Post











Common Ragweed

- Plants confirmed to have resistance to glyphosate, ALS and PPO herbicides on the Eastern Shore
- Plants collected from Southern MD confirmed to have resistance to ALS and glyphosate herbicides
- Commonly found in many states to our south



	Firstrate (ALS)	RoundUp	Reflex (PPO)
% Survival			
Common Ragweed-Chaptico	50	100	
Common Ragweed Ldt location 1	80	95	0
Common Ragweed Ldt location 2	90	95	0
Common Ragweed Clements	90	5	0

Ragweed Biology

- Ragweed has male and female flowers on the same plant
- Seed is large and can survive in the soil for 15-20 years
- The germination process is complex- seeds first go through a cold dormancy period.
- Normally only the seed near the surface will germinate-requires both light and temperature
- Plants can germinate early in the season.

Ragweed Management

- As with other weeds, ragweed that is larger than 3-4 inches, or under stress is very hard to control
- Many failures occur when early germinating ragweed is not controlled prior to planting
- Glyphosate and ALS type herbicides will not control herbicide resistant bio types

Ragweed Management-RR Beans

1. Kill any emerged ragweed plants prior to planting. 2,4-D or Dicamba can be tank-mixed with glyphosate. Gramazone is also a choice for small plants. Sharpen also works. Tillage also works, but will bring up new weed seeds.
2. Always use a residual- PPO's should be used where ALS resistance is known. Valor or Valor premixes have performed well in University test. Authority type products are not very effective for Ragweed.
3. Metribuzin and Linuron also has fairly good activity on Ragweed
4. Follow-up with timely post treatment if needed. PPO's such as Cobra or Flexstar.







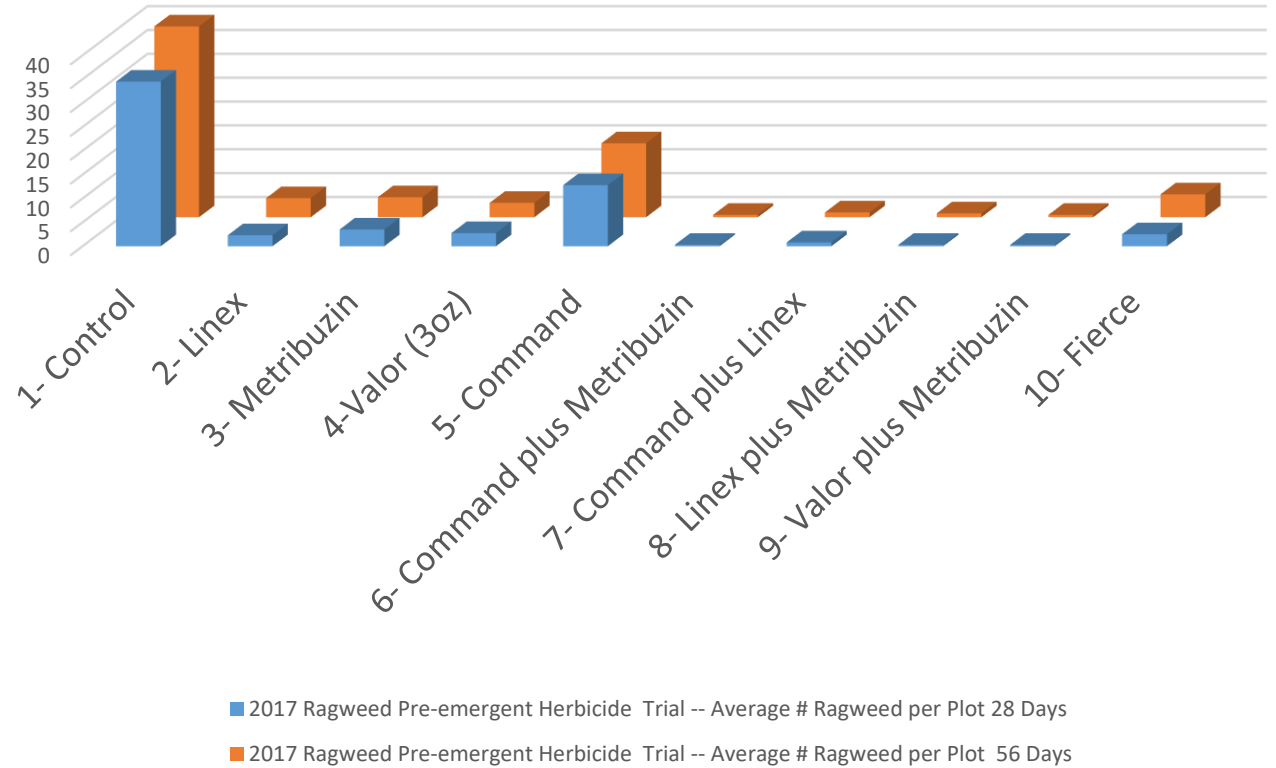






2017 Ragweed Pre-emergent Herbicide Trial -- Average # Ragweed per Plot

Treatment	28 Days	56 Days
1- Control	34.5	40
2- Linex 1.5 pts	2.3	4
3- Metribuzin 4 oz	3.5	4.2
4-Valor 3 oz	2.75	3
5- Command 2.66 pts	12.8	15.5
6- Command + Metribuzin 2.66 pts + 4 oz	0.3	0.5
7- Command + Linex 2.66 pts + 4 oz	0.8	1
8- Linex + Metribuzin .75 pts +4 oz	0.3	0.8
9- Valor + Metribuzin 3 oz +4 oz	0.3	0.5
10- Fierce	2.5	4.8



Other Ragweed (and Palmer) Options

- RR2 Xtend (Dicamba, Glyphosate)
- LibertyLink (Glufosinate)
- LibertyLink GT27 (Glufosinate, Glyphosate, HPPD??)
- Enlist Beans (2,4-D, Glyphosate)
- Enlist E3 Beans (2,4-D, Glyphosate, Glufosinate) (2019??)



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David Cross-R&D Cross SS

Earnest Morgan
Chip Bowling
Malcom Goode



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